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MEXICAN SPOTTED OWL INVENTORY

in CANYONLANDS NATIONAL PARK

2002–2003

For External Use

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EXECUTIVE SUMMARY

We have completed the final year of a two-year study to inventory Mexican spotted owls (*Strix occidentalis lucida*) within Canyonlands National Park (CANY). The U.S. Fish and Wildlife Service federally listed the Mexican spotted owl (MSO) (*Strix occidentalis lucida*) as a Threatened species in 1993 (USDI 1993). A significant area in Canyonlands National Park (CANY) has been designated as critical habitat for the Mexican spotted owl by the U.S. Fish and Wildlife Service (2001). Canyonlands National Park is considered one of the major population centers of the MSO on the Colorado Plateau. We surveyed known territories and potential habitat. During 2002-2003, we completed 37 field outings for a total of 99 survey days.

Most of the existing twenty-two Protected Activity Centers (PAC) in CANY were surveyed sometime during 2002 and 2003. A total of 47 Mexican spotted owls were confirmed within CANY in 2002-2003. This total was comprised of 10 pairs and 27 individuals, including 2 pairs and 5 individuals in the Maze District, 3 pairs and 7 individuals in the Island-in-the-Sky District, and 5 pairs plus the remaining 15 individuals in the Needles District.

It appears that the MSO prefers areas where human activities and impacts are minimal in intensity and duration. This has been confirmed by Swarthout and Steidl (Swarthout, 1999; Steidl, 1996; Swarthout and Steidl, 2000, 2001, 2003), and is evidenced by the existence of such a high density of MSOs in less visited areas such as upper Salt Creek, Five Fingers, and the West Fork area, and by the apparent movement of MSOs away from the White Rim trail to more remote less visited canyons. It also appears that the MSO prefers areas with standing water and healthy pockets of riparian vegetation, such as upper Salt Creek, Shot Canyon, Lost Canyon, and Jasper Canyon, as opposed to the more human and hydrologically impacted lower Salt Creek.

MANAGEMENT CONSIDERATIONS AND ONGOING THREATS

Visitor Impacts

The most significant threat to the MSO in CANY is increased human activities in the remote backcountry (Swarthout and Steidl, 2000, 2001, 2003; Swarthout, 1999; and Steidl, 1996). Swarthout's studies (1999) concluded that cumulative effects of high levels of short-duration recreational hiking near nests may be detrimental to Mexican spotted owls. The two researchers recommended a 205-meter radius buffer zone around occupied nests during the pre-nesting phase (mid-March) and continuing until the young fledge (beginning of June), or until owls have finished nesting. With this in mind, the CANY backcountry planning process should have critical habitat of the federally Threatened Mexican spotted owl as a primary consideration.

Degradation of Riparian Areas

Another significant threat to Mexican spotted owls is the loss and degradation of riparian habitat. Riparian habitat provides invaluable cover and prey for the MSO in CANY. The National Park Service took a very positive step in the protection of the MSO by closing part of the road in Salt Creek to vehicular traffic in 1998. Studies show that roads in general, and the old Salt Creek road in particular, negatively alter the hydrologic functioning of the adjacent riparian habitat (Schelz 2001). Roads and trails in riparian areas can lower the water table to the extent that the once extensive riparian habitat shrinks or disappears. For these reasons, all roads and trails in CANY should be removed from riparian areas wherever possible, and where it is not possible, some basic design considerations should be incorporated to mitigate the negative effects to the riparian areas.

Scientific Over-Utilization

Scientific over-utilization is another threat to the MSO in CANY and elsewhere. High intensity and/or manipulative research can have severe effects on MSO longevity and productivity (USDI Fish and Wildlife Service 1995). Highly manipulative techniques, such as radio-tagging and feather banding can have a detrimental effect. Although these activities should probably not be totally banned, management must seriously consider the negative ramifications to the MSO population when allowing these activities. Less intrusive research based on old-fashioned intensive observation is the preferred course of action.

Surrounding Lands Management

There appears to be many more MSOs in CANY than in similar adjacent habitat. The MSO Recovery Plan provides a basis for management actions to be undertaken by land-management agencies and Indian Tribes to remove recognized threats and recover the spotted owl. Primary actions will be taken by the USDA Forest Service, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI Bureau of Indian Affairs, and sovereign American Indian Tribes (USDI 1995).

Most of the lands around CANY are managed by the federal government, either the Bureau of Land Management (BLM), Forest Service (FS) or Glen Canyon National Recreation Area. Management of these areas should be monitored closely by CANY management for present and proposed activities that can have serious detrimental effects on the MSO. Detrimental activities might include vegetation or habitat manipulation, riparian degradation by off-road vehicles and grazing, and oil and gas and mineral development. Oil and gas and mineral development has been encouraged by the current administration and these activities are likely to increase in the near future. The noise and disturbance accompanying these activities may not directly effect CANY MSOs but they will have an indirect effect. And in the surrounding areas, the noise and disturbance will have a direct effect on any present or future MSOs or MSO habitat. These activities can only serve to isolate CANY MSO populations further from other populations and thus have a long-term detrimental effect on our MSO population's genetic stability, health, and survivorship.

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1. INTRODUCTION



The U.S. Fish and Wildlife Service (USDI 1993) federally listed the Mexican spotted owl (MSO) (*Strix occidentalis lucida*) as a Threatened species in 1993. A significant area in Canyonlands National Park (CANY) has been established as critical habitat for the Mexican spotted owl by the U.S. Fish and Wildlife Service (2001). Canyonlands National Park is considered one of the major population centers of the MSO on the Colorado Plateau. Before 2002, MSO surveys had been performed (Wiley 1995, 1997, 1998), but little monitoring of known territories and no searches for new sites had been conducted since 1997. There were some areas in the park where we had reports of MSOs but no official records. This is the final report of a two-year inventory of the distribution of the MSO in Canyonlands National Park.

1.1 OBJECTIVES

The primary goal of this project was to determine the numerical status and distribution of the Mexican spotted owl within Canyonlands National Park. Secondary objectives included determining pair occupancy, assessing reproductive status, and locating roost and nest sites. This information will be used to estimate trends in pair occupancy over time, trends in breeding status, and reproductive success through time, and to assess whether management activities need to be altered to ensure viable populations of the MSO in Canyonlands.

Following are the objectives of the 2002-2003 Mexican spotted owl inventory in Canyonlands National Park:

Objective 1: To inventory all known and potential MSO habitat in Canyonlands National Park.

Objective 2: To document distribution, abundance, and breeding status of the MSO in Canyonlands National Park.

Objective 3: To map all survey routes and active MSO territories using Global Positioning System (GPS) and Geographic Information System (GIS).

Objective 4: To create a final report summarizing all historic data and current inventory and monitoring data and protocols, and to enter all survey results into the database management framework currently being developed by the Northern Colorado Plateau Inventory and Monitoring Network. These steps will help ensure the long-term security, compatibility, and accessibility of the data.

1.2 EXPECTED PRODUCTS

Product 1: A map of all survey routes and found MSO territories using GPS and GIS. All survey results will be entered into the database management framework currently being developed by the Northern Colorado Plateau Inventory and Monitoring Network.

Product 2: A final report will contain an historic summary of past work and findings, and the 2002-2003 findings of this project. It will include a map of all areas surveyed regardless of whether or not owls were found. It will also include discussion and recommendations for future monitoring. Management issues will also be addressed with management recommendations for the future.

1.3 HISTORY OF THE MSO IN CANYONLANDS NATIONAL PARK

Historic records of the Mexican spotted owl in southern Utah parks are scattered throughout the literature and date back to the 1920's. The earliest published record is from arid canyon habitat in Zion National Park in 1928 (Hayward et al. 1976). Atwood and others (1980) reported a MSO seen in 1957 in Davis Gulch, a dry tributary of the Escalante River. Three Mexican spotted owls were seen in 1958 in a small side canyon in Glen Canyon, and one in the mouth of the Escalante River. Since the 1970's a number of territories and nest sites have been found on the Colorado Plateau. About 22 territories were documented in Canyonlands National Park by 1997. The northern-most location of a MSO was reported by Willey (1995) in Dinosaur National Monument. The majority of known territories on the Colorado Plateau occur within Canyonlands National Park, Zion National Park, Capitol Reef National Park, Grand Canyon National Park, and adjacent BLM and Forest Service lands.

History of Surveys and Protected Activity Center Development in Canyonlands National Park

Johnson and Johnson first recorded the MSO in Canyonlands in 1977. They listed a number of sightings in the Needles District. After the eventual discovery of several breeding pairs and the federal listing of the MSO as a threatened species in 1993, intensive study of the MSO was conducted in CANY throughout the 1990s (Van Riper and Willey 1992; Willey 1995, 1996, 1998; Willey and Van Riper 2000; Swarthout and Steidl 2000). See **Figure 1** for a map of historic locations of the MSO in CANY. These studies, using a variety of methods, addressed demographics, sensitivity to recreational disturbance, prey base, home range size, habitat use, and natal dispersal of the birds.

As of 1998, surveys in CANY documented 22 historic MSO territories throughout the three districts of the park (Willey 1998). With ten territories, the Needles District of CANY contains the highest concentration of known territories, while the Maze and Island-in-the-Sky Districts contain the remainder in approximate equal amounts. All of these known territories are now encompassed within Protected Activity Centers (PACs). Canyonlands National Park currently has 22 established PACs, 12 in the Needles District and five each in the Maze and Island in the Sky Districts. The process for delineating the PACs started at the Mexican Spotted Owl Interagency and Utah Implementation Committee Meeting held in Moab, Utah, in November, 1996. This meeting was attended by at least 27 people from various agencies and interest groups. The owl territories were discussed individually by the group and decisions were made regarding which territories would be included within a PAC (Zablan 1996). The final PAC boundaries were delineated sometime in early 1997. One known territory did not receive a PAC (Musselman Arch). There was some confusion regarding the UTM coordinates from Musselman Arch being switched with the UTM coordinates from Shafer Canyon (Sloan, pers. comm.). Despite intensive surveys in the past, only an estimated 60-70 percent of potential MSO habitat had been surveyed within Canyonlands National Park. David Willey (1998) estimated in 1998 that 70-80 percent of potential habitat had been checked for Mexican spotted owls in arid, steep-walled canyon country in Utah.

History of Mexican Spotted Owl Research in Canyonlands National Park

During 1991-1992 Willey (1992) studied two primary niche dimensions of the MSO in CANY. The first was the habitat niche (nest, roost, and foraging habitat), and the second was prey-use during nestling stage of the

This Figure contains sensitive information To obtain this information contact:

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FIGURE 1. Historic Locations of Mexican Spotted Owls at CANY prior to 2002-2003 Surveys.

reproductive cycle. He also attempted to develop a predictive model to identify suitable Mexican spotted owl habitat throughout CANY.

In 1991-1992, Van Riper and Wiley (1992) investigated habitat use, home-range size, and juvenile dispersal in three parks of the Colorado Plateau, including CANY. Adults and juveniles were trapped and radio transmitters attached. Home-range size for adults averaged 445 ha and ranged from 225-675 ha. Adults spent 25 percent of their nighttime activities outside the steep canyon terrain on benchlands and mesa tops, and the remaining time within the steep canyons. In 1995, Willey (1995) surveyed extensively in Canyonlands National Park and found 18 territories. Willey's Ph.D. dissertation project (1998) addressed most of the previous work he started in 1991 along with additional work on the ecology of Mexican spotted owls in national parks on the Colorado Plateau. The first phase of his dissertation described the inventory and monitoring of Mexican spotted owls on the Colorado Plateau. Much of this work was in CANY, where he found twenty Mexican spotted owls, the largest concentration in the region. The second phase of his research focused on home-range characteristics and habitat used by a sample of spotted owls located during the inventory phase. Spotted owls were captured and radio-tagged and radiotelemetry was used to describe home range and habitat used during 1991-1995. The final project phase focused on the examination of natal dispersal behavior by juvenile spotted owls. Dispersal is an important demographic factor that can strongly influence population dynamics and genetic structure in birds (Willey 1998, Willey and Van Riper 2000). He found that juvenile spotted owls dispersed from their nest areas during August-October each year, with 85 percent leaving in September. The onset of dispersal was sudden and in random directions away from the nest core area.

1.4 THREATS TO THE MEXICAN SPOTTED OWL

Potential threats to the productivity and survival of the MSO in the Canyonlands National Park area include:

- 1) Recreation
- 2) Loss or degradation of riparian habitat
- 3) Road maintenance and development
- 4) Oil and gas leasing and mineral development
- 5) Vegetation manipulation
- 6) Research over-utilization
- 7) Grazing
- 8) Timber harvest

The most significant threats to the owl in CANY are increased human activities in the remote backcountry (Swarthout 1999) and loss of habitat on adjacent lands. Swarthout (1999) studied the effects of increased recreation on the MSO and concluded that cumulative effects of high levels of short-duration recreational hiking near nests may be detrimental to Mexican spotted owls. He recommended a 205 meter radius buffer zone around occupied nests during the pre-nesting phase (mid-March) and continuing until the young fledge (beginning of June), or until owls have finished nesting.

1.5 NATURAL HISTORY

Although the Mexican spotted owl eats a variety of mammals, birds, reptiles, and insects, the bulk of its diet is woodrats, deer mice, and voles. The owl usually forages from sunset to daylight. It catches prey by diving on it from a tree or a ledge. This method is sometimes called a “perch and pounce” strategy (Forsman 1976). Mexican spotted owls have also been observed capturing flying prey, such as birds, bats, or insects (USDOI 1995). In the Canyonlands region, the MSO typically occurs in steep-walled rocky canyons, below 8000 feet elevation, with no or few trees. Nests in southern Utah have only been found in caves, in cracks, or on ledges in these steep-walled canyons (Howe 1998).

Mexican spotted owls first breed at two to three years of age. Adults are solitary during the fall and pairs begin to roost together in February or March. Adults occupy the same breeding territory year after year. Mexican spotted owls have a very low reproductive rate compared to other owls, laying an average of two eggs, and they do not breed every year. The eggs are laid and incubated only by the female. The male feeds the female and eventually the young. The young leave the nest before they can fly, and remain with the adults for at least a month. The young may or may not leave the nest area in the fall (Howe 1998).

Adult owls have high survival rates (80-90 percent) and may live up to 16 years. However, their low reproductive rate combined with a 20 percent survival rate of young to adulthood, affects their numbers. Starvation is a major cause of juvenile death, although predators, such as great horned owls and northern goshawks, may also be a factor (Howe 1998). Several mortality factors have been identified for all ages of Mexican spotted owls. These include predation by other owls and raptors, starvation due to lack of resources, accidents, and disease and parasites (USDI 1995).

Most territories are centered around core nest sites. Nest sites are located in rugged and steep canyon topography with vertical cliffs and numerous caves. There are commonly small patches of woodland vegetation, with pinyon-juniper being the most common type. The rocky and arid breeding habitat in southern Utah is unique for spotted owls, which typically occupy late-seral stage forest habitat in the West (Forsman et al. 1984, Seamans and Gutierrez 1995). The strong association between the owls and steep canyon topography suggests that Canyonlands National Park provides ideal habitat for the Mexican spotted owl.

1.6 GENERAL PARK INFORMATION

Location: Canyonlands National Park is located in southeast Utah along the Colorado and Green Rivers in Grand, Garfield, San Juan and Wayne Counties. The park is southwest of nearby Moab, Utah, 110 miles (183 kilometers) southwest of Grand Junction, Colorado, and 240 miles (400 kilometers) southeast of Salt Lake City, Utah. Parts of the park are accessible by major travel routes including Interstate I-70 and Utah Highway 191 (see **Figure 2**).

Elevation: The elevation within the park ranges from approximately 3,900 feet on the Colorado River south of Cataract Canyon to 7,180 feet above Big Pocket in the Needles District.

General Description: Canyonlands National Park has been expanded since it was originally established in 1964 to its present size of 337,370 acres (136,587 hectares), centered on the confluence of the Green and Colorado Rivers. The rivers divide the park into three geographical districts: the Island in the Sky District is the triangle of land between the two rivers, the Needles District lies east of the Colorado River, and the Maze District lies to the west of the Colorado and Green Rivers. The Horseshoe Canyon Detached Unit is managed as part of the Maze District. The Green and Colorado River corridors, referred to as the River District, are managed in conjunction with the Island in the Sky District of the park. In summary, the park is divided into the Island in the Sky, Maze, Needles and River districts.

From prehistoric Native Americans searching for chert outcrops, to the 1860s and 1870s geological investigations of John Wesley Powell, to turn-of-the-century explorers, to oil explorers dating from the 1910s, to uranium miners of the 1950s, the geologic resources of Canyonlands have been of major interest and importance. As a result of these explorers, miners and recreationists, geological publications on the park are widely available and the geological resources of the park are well-known (Baars and Molenaar 1971; Huntton, Billingsley and Breed 1982; Mutschler 1969).

For park visitors, probably the three most striking geological formations of the park are the uniquely banded red and white sandstone of the Cedar Mesa Formation exposed in the Needles and Maze Districts, the sinuous White Rim Sandstone exposed on the platform rim between mesa top and rivers in the Island in the Sky District, and the vertical red cliffs of Wingate Sandstone, exposed high in the Island in the Sky District and above the Maze District.

The incredible features of the park include the remote mesas, buttes, and deep canyons cut by the Green and Colorado Rivers and their tributaries. The park's name is derived from the geology term "Canyon Lands", which is defined as the province south of the Uinta Basin and between the High Plateaus to the west and the Rocky Mountains to the east. As explained by Stokes (1988), the park lies at the rugged and remote heart of the Canyon Lands section of the Colorado Plateau physiographic province in southeast Utah. The park is characterized by sedimentary rock, which has been deformed into anticlines, synclines, monoclines, and salt tectonic structures. Uplift of the Colorado Plateau, with concurrent and subsequent water erosion, have produced the extensive, deep canyon systems which are the defining features of the park and of the physiographic section (Lammers 1991).

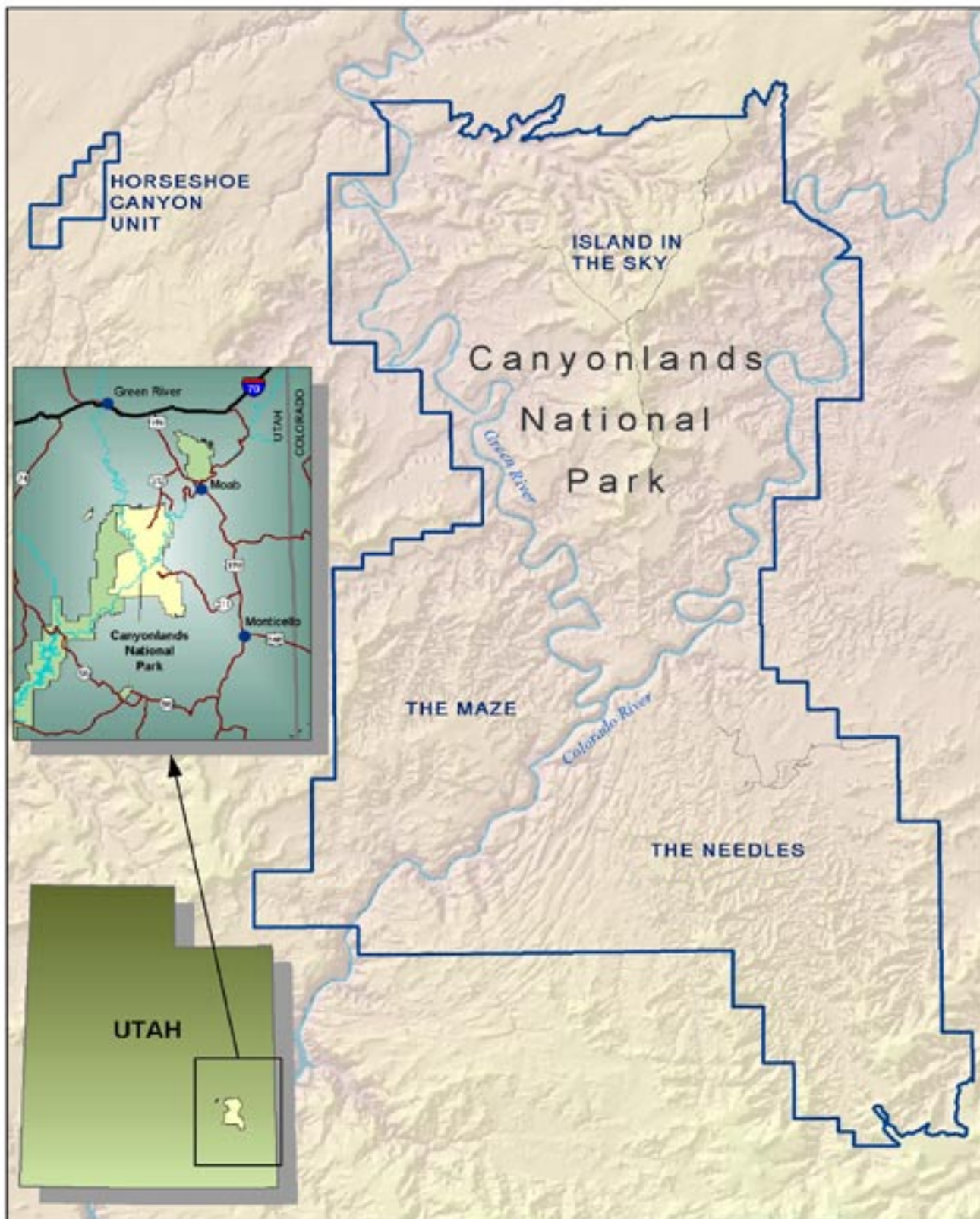


FIGURE 2. Map and Location of Canyonlands National Park

There are seven sedimentary formations plus a laterally varied group of formations exposed in the park, ranging in age from the Paleozoic Pennsylvanian Period to the Mesozoic Jurassic Period. In stratigraphic order starting with the oldest, these are the Paradox Formation, Honaker Trail Formation, Cutler Group, Moenkopi Formation, Chinle Formation, Wingate Sandstone, Kayenta Formation, and Navajo Sandstone.

The layers of the Permian Cutler Group represent varied and transitional environments. Red layers in easternmost Canyonlands are usually referred to as the Cutler Undivided. Several distinct formations in most of the park include, from the oldest up, the Halgaito Shale, Elephant Canyon Formation (a disputable unit among geologists), Cedar Mesa Sandstone, Organ Rock Shale, and White Rim Sandstone.

The Permian Paradox Formation of salt and gypsum evaporites is highly plastic and played a key role in the many structures within and near Canyonlands. The buried salt flowed and formed domes and anticlinal structures. Erosion eventually led to ground-water dissolution of the salt, causing the collapse of overlying layers, and the resulting valleys.

Climate

Canyonlands National Park is arid. It is characterized by hot, dry summers and cool to cold winters. Temperatures in the park vary with altitude and latitude (Brough, Jones and Stevens 1987). In the Needles District at an elevation of 5,040 feet the average maximum temperature is 68.3° F, and the average minimum is 37.8° F. The average annual precipitation is 8.62 inches. In the Island in the Sky District at an elevation of 5,930 feet, the average maximum temperature is 64.1° F, and the average minimum temperature is 42.2° F. Temperatures have reached as high as 110° F and as low as -16° F. The average annual precipitation is 9.27 inches. Potential evapotranspiration far exceeds precipitation, making effective soil moisture a critical environmental factor. Precipitation peaks most commonly occur in March, July/August, and October. Snow commonly falls between November and March. Another generalization is that climate statistics vary from year to year, extremes are common, and an average year or an average season is rare.

1.7 MSO CONCEPTUAL ECOLOGICAL MODEL

An ecological conceptual model of the Mexican spotted owl in Canyonlands is presented in **Figure 3**. The intention of this model is to stimulate discussion and comments for increased understanding of the various external factors affecting the MSO, and to assist in the guidance of stressor analysis and determination of vital sign indicators for the MSO.

Since the MSO is a federally Threatened species, ongoing monitoring is mandated (USDI 1995). For Colorado Plateau MSO populations, this monitoring must include the regulation and management of threats to the MSO so that they are sufficiently moderated and/or regulated. This monitoring must also include assurances that the existing habitat is of a quality to sustain persistent MSO populations that are stable or increasing (USDI 1995).

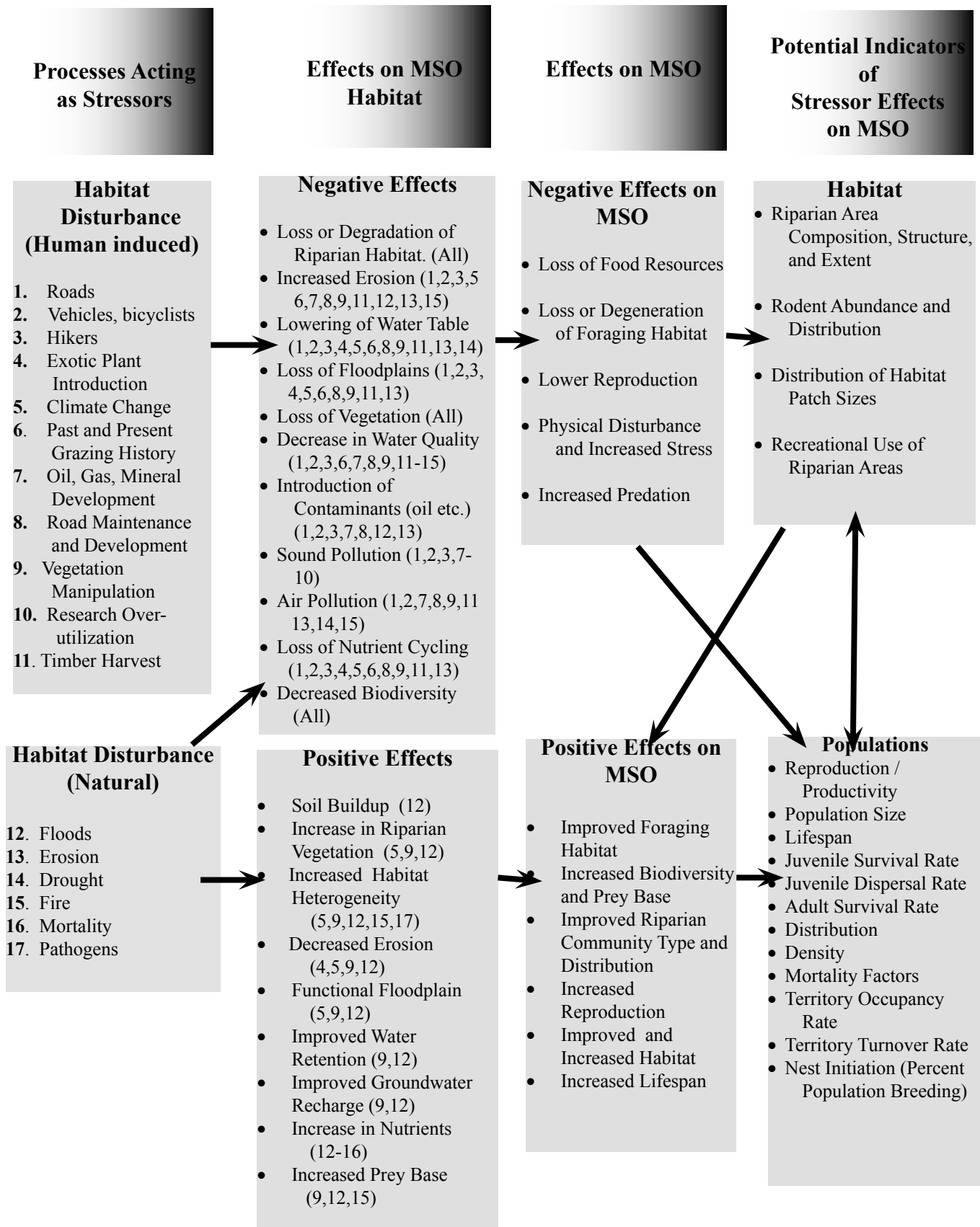


FIGURE 3. Conceptual Ecological Model of Stressors and Impacts on the MSO (Schelz and Svendsen 2002).

2. METHODS



Buck Canyon in Island-in-the-Sky District of Canyonlands National Park

2.1 GENERAL METHODS

Our survey methods were based upon the Mexican Spotted Owl Inventory Protocol, which we were trained in during the United States Fish and Wildlife Service (USFWS) Mexican spotted owl trainings held in Moab, Utah in March 2002 and March 2003 (USDA 1991) (see **Appendix B**). This protocol is based on the U.S. Forest Service Region 3 Interim Directive Number 2 (USDA 1991), and includes various changes suggested by Frank Howe (UDWR, Mexican Spotted Owl Team Leader), Laura Romin (USFWS, Endangered Species Coordinator) and the rest of the Mexican Spotted Owl Recovery Team. We modified the protocol to better suit our purposes of this general inventory as follows. Instead of remaining at each calling station for twenty minutes, we stayed for fifteen minutes. In order to save on transit times, we did not make daytime follow-up visits in some remote backcountry areas. We did not return for a second survey in an effort to establish presence, except in a few locations.

The most effective way to detect the presence of Mexican spotted owls is to use the human voice to mimic their calls, and listen for a response (Forsman 1983, Ganey 1988). We used a mixture of spotted owl calls, primarily the four-note location call, but also including the contact whistle, series hoot, and bark call. We used a combination of calling points and continuous calling between those points. A minimum of fifteen minutes was spent at each calling point, alternating between calling and listening with three minute intervals (Ganey 1988, Rinkevich 1991, Willey 1993).

The calling points did not exceed one-half mile apart from one another, and the combination of the two survey methods ensured complete coverage of the survey area. UTM coordinates were acquired at each calling point using a hand-held GPS unit (Garmin GPS III Plus) and both calling points and continuous calling locations were recorded on USGS topographical quad maps. Our surveys all took place between dusk and dawn.

Information gathered on the data sheets included location of survey; district of the park; whether the survey was an inventory or monitoring visit; survey and outing number; whether or not the survey was complete and whether or not it was aborted; visit results; wind speed, percent of cloud cover, precipitation and temperature at the start and end of the survey as well as at every calling point; call point id; survey method; start, end and total time; call method; whether or not the moon was visible; and UTM's including estimate of position error (EPE). If a Mexican spotted owl was detected we recorded two compass bearings from a known point, whether it was visually or audibly detected, sex if known, and, if possible, a UTM from the owl's location. See **Appendix A** for samples of completed data sheets.

2.2 EQUIPMENT

- Garmin GPS III Plus hand-held GPS unit
- Petzl duo-belt headlight, with both standard and halogen light bulbs
- Two back-up light sources, one of which should provide plenty of light, such as a Mag-light (4 D cells)
- Topographical quad maps
- Data sheets with extra writing tools
- Compass to take bearings
- Camera and film to record owls during day-time follow-up visits
- Thermometer

2.3 ANALYSIS AND DATA MANAGEMENT

Data Management

It is important to safeguard monitoring data associated with these projects. With the initiation of the Northern Colorado Plateau Network Inventory and Monitoring Program in 2000, plans are currently underway for coordinated and ongoing network-wide management of inventory and monitoring-related data. These MSO monitoring studies will be incorporated into the network data management framework, which will help ensure the long-term security, compatibility, and accessibility of the data.

All data sets are in MS EXCEL and MS ACCESS. They are stored in the computer of the biologist of the Southeast Utah Group. All files are backed up in the Southeast Utah Group headquarters network P: drive under cschelz\birds\MSO, and on 750mb Compact Discs.

2.4 MEXICAN SPOTTED OWL HABITAT MODEL

The Mexican spotted owl habitat model developed by Spotsky (1997; see **Figure 4**), was used to design and plan 2002 field surveys.

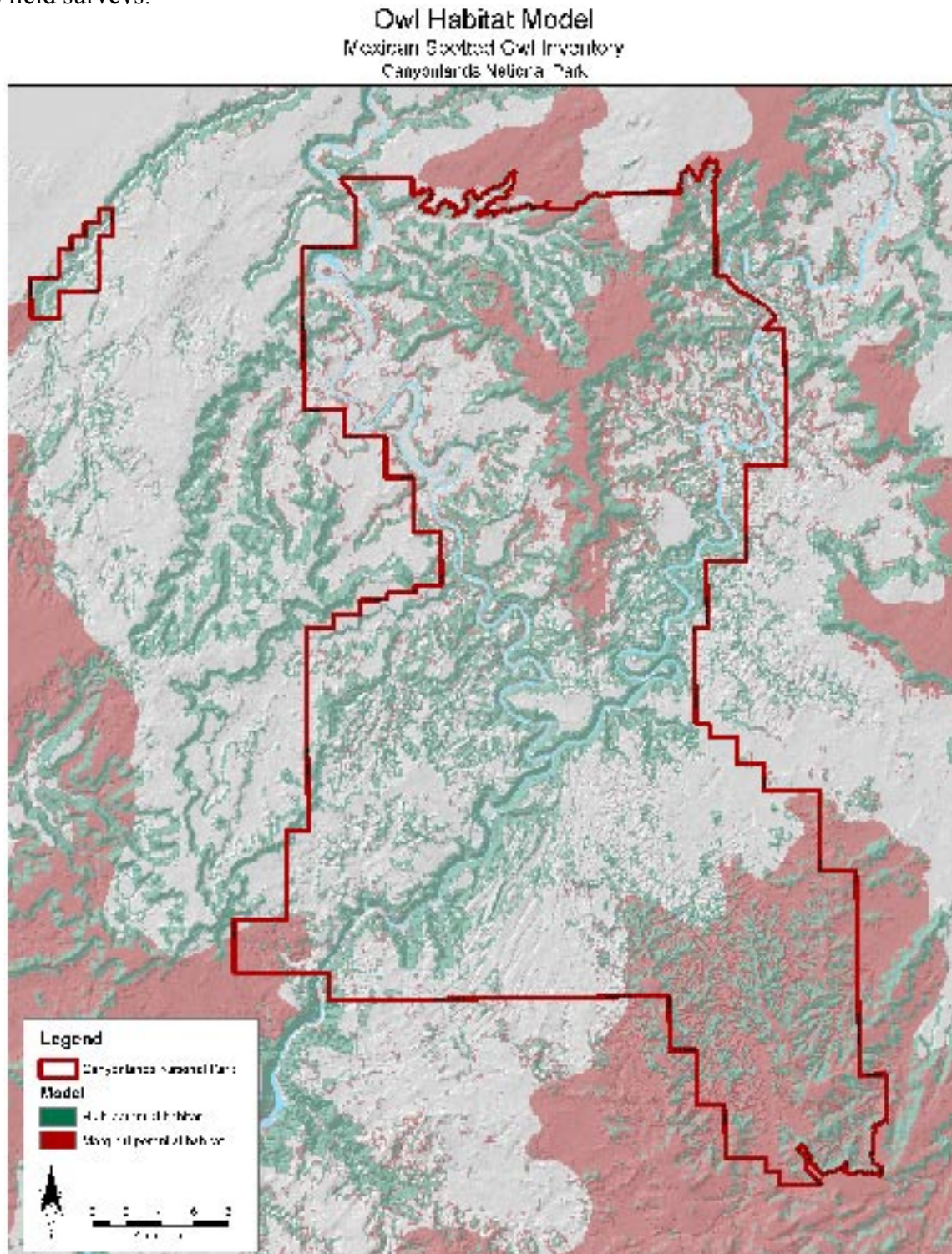


FIGURE 4. Mexican Spotted Owl Habitat Model of Canyonlands National Park (Spotsky 1997).

3. RESULTS



Monument Basin in the Island-in-the-Sky District of Canyonlands National Park

3.1 SURVEY LOCATIONS

During the 2002 and 2003 field seasons we executed 37 field outings for a total of 99 survey days (see **Table 1**). We completed 15 trips and 26 surveys in the Island-in-the-Sky District, including 2 trips down the Colorado River (River 1 and ISKY 16); 5 trips and 29 surveys in the Maze District; and 15 trips and 43 surveys in the Needles District (see **Table 1 and 2**). See **Figures 5-7** for survey routes completed in 2002 and 2003. The first field outing began on March 25th and the last outing began on August 24th. In addition to the formal Mexican spotted owl inventory conducted by David Svendsen in 2002, and Dan Kent and D'ahna Chalmers in 2003, another National Park Service biological technician, William Sloan, conducted various surveys both within existing Protected Activity Centers (PACs) and in potential Mexican spotted owl habitat (see **Table 3**). Sloan confirmed occupancy in three PACs: Little Bridge Canyon (Island-in-the-Sky District), Separation Canyon (Needles District), and Upper Horse Canyon (Needles District). Sloan also surveyed an additional three PACs,

as well as three other areas of potential Mexican spotted owl habitat, with no owls detected. Charles Schelz, biologist for Canyonlands National Park, also conducted surveys in Buck Canyon PAC (Island-in-the-Sky District) and Horseshoe Canyon (Maze District). Sonya Daw, NPS biological technician, also conducted a couple of surveys in the Needles and Maze Districts.

Of the twenty-two existing PACs within Canyonlands National park, we surveyed all except three during 2002-2003. Of these, owls were detected in 19 PACs (see **Table 6**).

TABLE 1. Mexican Spotted Owl Field Trips in Canyonlands National Park, Sorted by Trip Number and District.

Trip Number	Location	Call Points	Dates	Survey Number
ISLAND-IN-THE-SKY DISTRICT				
ISKY 1	Trail and Rough Canyons	1001-1015	4/9 to 4/12/02	1
ISKY 2	Shafer Canyon and Island	1016-1027	6/5 to 6/6/02	1
ISKY 3	Syncline Valley	1028-1031	7/23/02	1
ISKY 4	Shafer, Gooseberry Canyons	1032-1042	8/12 to 8/14/02	2
ISKY 5	Syncline, Rough Canyons	1043-1051	9/16 to 9/17/02	2
ISKY 6	Taylor Canyon	1052	4/26/2003	1
ISKY 7	Shafer Canyon	1053-1074	4/27/03	1
ISKY 8	Neck Spring Trail	1075-1084	5/12/2003	1
ISKY 9	Canyon West of Gray's Past.	1085-1091	5/20/2003	1
ISKY 10	Shafer / Musselman Rim	1092-1096	5/21/2003	1
ISKY 11	Alcove Spring Rim	1097-1103	5/22/2003	1
ISKY 12	Upheaval / Syncline	1104-1115	5/25/2003	1
ISKY 13	Aztec Butte East	1116-1120	5/27/2003	1
ISKY 14	Aztec Butte West	1121-1123	5/30/2003	1
ISKY 15	Colorado River Canyons	1124-1198	6/04 to 6/10/03	6
ISKY 16	Monument/Lathrop/Buck Cyn	1198-1242	7/19 to 7/20/03	4
River 1	Cataract Canyon	R001-R008	6/10 to 6/12/02	1
MAZE DISTRICT				
Maze 1	Maze Area	M001-M022	5/20 to 5/24/02	1
Maze 2	Horseshoe Canyon	M023-M034	8/21 to 8/22/02	1
Maze 3	South Maze	M035-M134	4/08 to 4/13/03	12
Maze 4	Inner Maze	M135-M244	5/4 to 5/10/03	12
Maze 5	Horseshoe Canyon	M245-M265	6/28 to 6/29/03	3
NEEDLES DISTRICT				
Needles 1	Salt Creek, Middle	N001-N024	3/25 to 3/28/02	1
Needles 2	Davis and Lavender Canyons	N025-N052	4/1 to 4/3/02	1
Needles 3	Lost Canyon	N053-N073	4/16 to 4/18/02	1
Needles 4	Chesler and Butler Canyons	N074-N114	4/27 to 5/2/02	1
Needles 5	Salt Creek, Upper	N115-N134	5/12 to 5/15/02	1
Needles 6	Big Spring Canyon	N135-N141	6/27 to 6/28/02	1
Needles 7	Big Spring and Salt Creek	N142-N160	7/30 to 8/2/02	1
Needles 8	Salt and Horse Creeks	N161-N184	8/6 to 8/8/02	2
Needles 9	Lavender Canyon	N185-N215	3/31 to 4/01/03	3
Needles 10	Lower Salt Creek	N216-N237	4/03 to 3/04/03	4
Needles 11	Davis Canyon	N238-N267	4/29 to 4/30/03	2
Needles 12	Big Spring Cyn, Vicinity	N268-N305	5/31 to 6/02/03	4
Needles 13	Upper Salt Creek	N306-N402	6/15 to 6/22/03	16
Needles 14	Elephant Canyon Area	N403-N436	7/03 to 7/04/03	2
Needles 15	Salt Creek	N437-N474	7/10 to 7/12/03	3

TABLE 2. MSO Field Trips in CANY Sorted by Date.

Trip Number	Location	Call Points	Dates	Survey Number
2002				
Needles 1	Salt Creek, Middle	N001-N024	3/25 to 3/28/02	1
Needles 2	Davis and Lavender Canyons	N025-N052	4/1 to 4/3/02	1
ISKY 1	Trail and Rough Canyons	I001-I015	4/9 to 4/12/02	1
Needles 3	Lost Canyon	N053-N073	4/16 to 4/18/02	1
Needles 4	Chesler and Butler Canyons	N074-N114	4/27 to 5/2/02	1
Needles 5	Salt Creek, Upper	N115-N134	5/12 to 5/15/02	1
Maze 1	Maze Area	M001-M022	5/20 to 5/24/02	1
ISKY 2	Shafer Canyon and Island	I016-I027	6/5 to 6/6/02	1
River 1	Cataract Canyon	R001-R008	6/10 to 6/12/02	1
Needles 6	Big Spring Canyon	N135-N141	6/27 to 6/28/02	1
ISKY 3	Syncline Valley	I028-I031	7/23/02	1
Needles 7	Big Spring and Salt Creek	N142-N160	7/30 to 8/2/02	1
Needles 8	Salt and Horse Creeks	N161-N184	8/6 to 8/8/02	2
ISKY 4	Shafer, Gooseberry Canyons	I032-I042	8/12 to 8/14/02	2
Maze 2	Horseshoe Canyon	M023-M034	8/21 to 8/22/02	1
2003				
ISKY 5	Syncline, Rough Canyons	I043-I051	9/6 to 9/17/02	2
Needles 9	Lavender Canyon	N185-N215	3/31 to 4/01/03	3
Needles 10	Lower Salt Creek	N216-N237	4/03 to 3/04/03	4
Maze 3	South Maze	M035-M134	4/08 to 4/13/03	12
ISKY 6	Taylor Canyon	I052	4/26/2003	1
ISKY 7	Shafer Canyon	I053-I074	4/27/03	1
Needles 11	Davis Canyon	N238-N267	4/29 to 4/30/03	2
Maze 4	Inner Maze	M135-M244	5/4 to 5/10/03	12
ISKY 8	Neck Spring Trail	I075-I084	5/12/2003	1
ISKY 9	Canyon West of Gray's Past.	I085-I091	5/20/2003	1
ISKY 10	Shafer / Musselman Rim	I092-I096	5/21/2003	1
ISKY 11	Alcove Spring Rim	I097-I103	5/22/2003	1
ISKY 12	Upheaval / Syncline	I104-I115	5/25/2003	1
ISKY 13	Aztec Butte East	I116-I120	5/27/2003	1
ISKY 14	Aztec Butte West	I121-I123	5/30/2003	1
Needles 12	Big Spring Cyn. Vicinity	N268-N305	5/31 to 6/02/03	4
ISKY 15	Colorado River Canyons	I124-I198	6/04 to 6/10/03	6
Needles 13	Upper Salt Creek	N306-N402	6/15 to 6/22/03	16
Maze 5	Horseshoe Canyon	M245-M265	6/28 to 6/29/03	3
Needles 14	Elephant Canyon Area	N403-N436	7/03 to 7/04/03	2
Needles 15	Salt Creek	N437-N474	7/10 to 7/12/03	3
ISKY 16	Monument/Lathrop/Buck Cyn	I198-I242	7/19 to 7/20/03	4

TABLE 3. Other Efforts During 2002 and 2003 to Locate Mexican Spotted Owls within Canyonlands National Park.

Location	Time spent	Personnel
ISLAND-IN-THE-SKY DISTRICT		
Buck Canyon	4 hours	William Sloan
Buck Canyon PAC	3 hours	Charles Schelz
Lathrop Canyon PAC	4 hours	William Sloan
Lathrop Canyon	4 hours	William Sloan
Little Bridge	4 hours	William Sloan
Musselman Canyon	8 hours	William Sloan
Musselman Canyon	4 hours	William Sloan
Shafer Canyon PAC	4 hours	William Sloan
Taylor Canyon	6 hours	William Sloan
Upheaval Bottom	4 hours	William Sloan
NEEDLES DISTRICT		
Big Spring Canyon	4 hours	Sonya Daw
Salt Creek PAC - Upper	6 hours	William Sloan
MAZE DISTRICT		
Horseshoe Canyon	6 hours	Charles Schelz
Horseshoe Canyon	6 hours	Sonya Daw

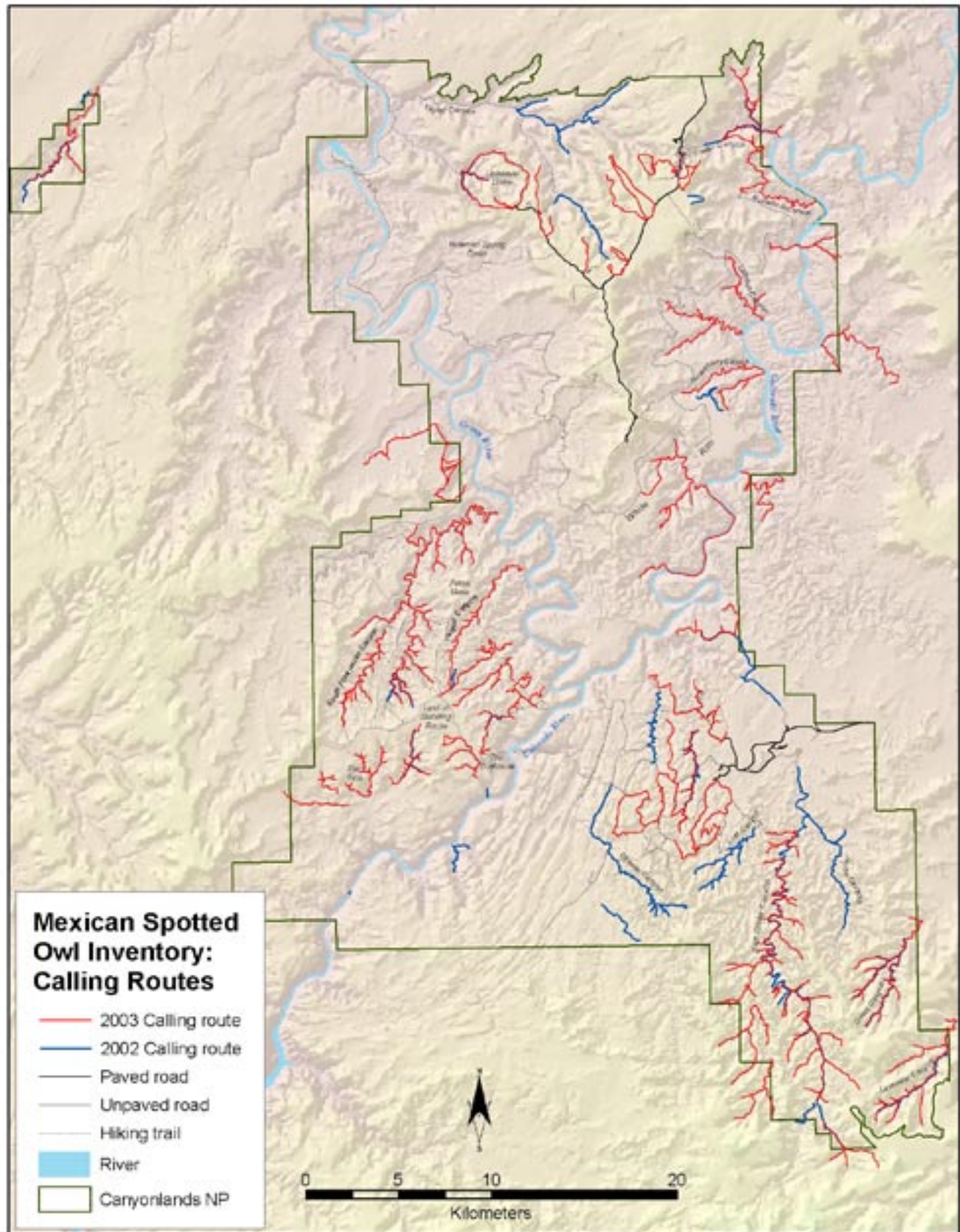


FIGURE 5. 2002-2003 Survey Routes in Canyonlands National Park.

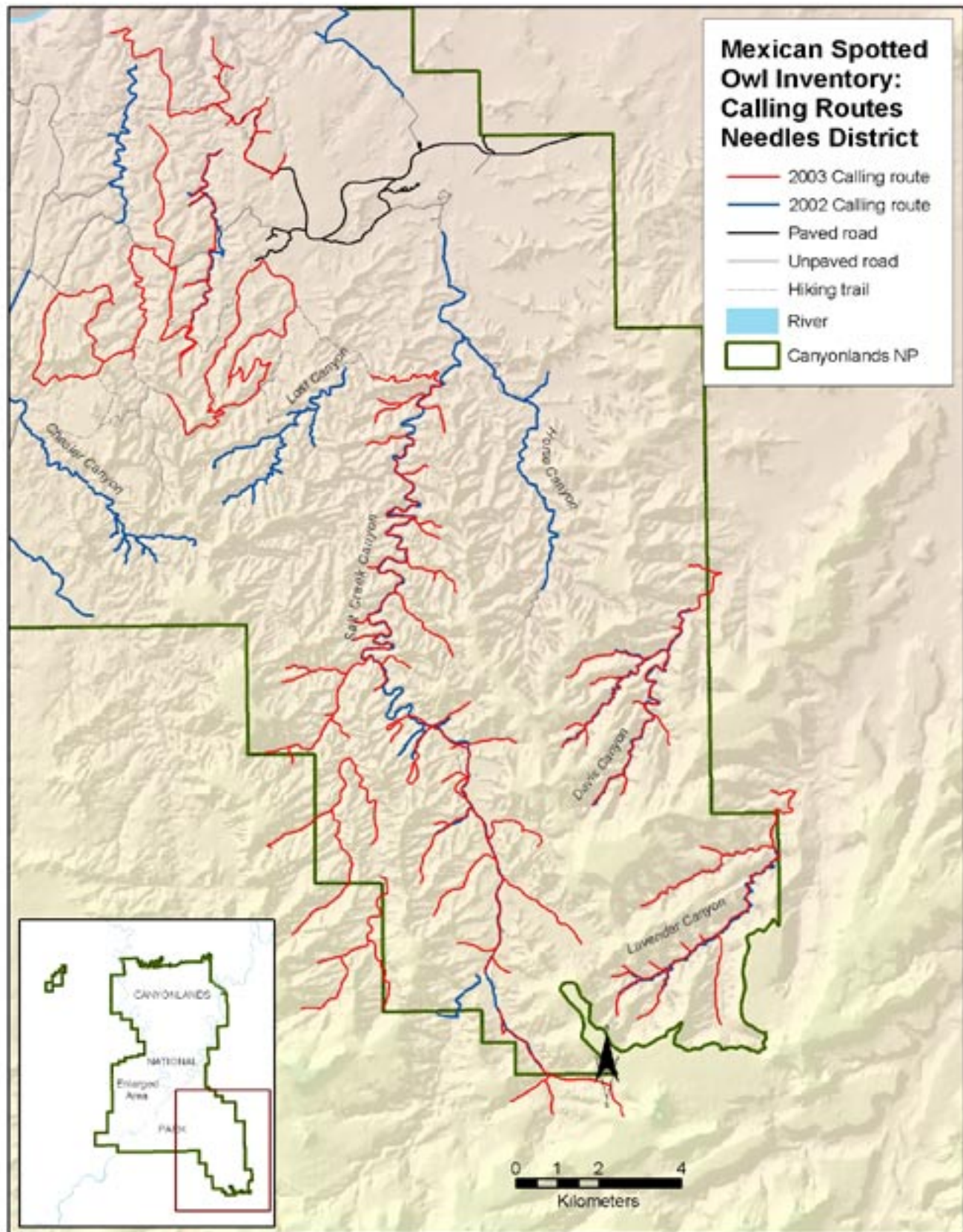


FIGURE 6. 2002-2003 Survey Routes in the Needles District of Canyonlands National Park.

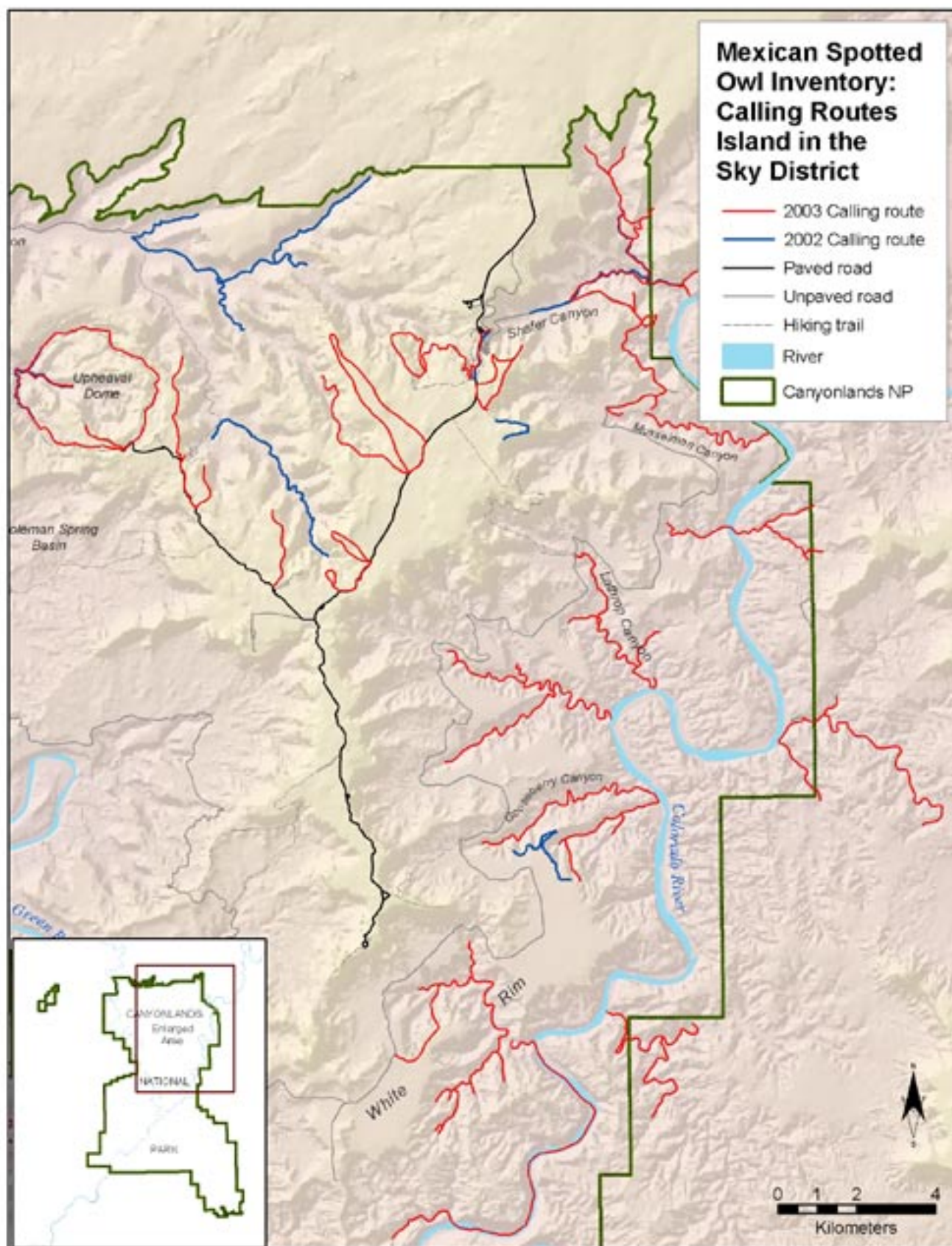


FIGURE 7. 2002-2003 Survey Routes in the Island-in-the-Sky District of Canyonlands National Park.

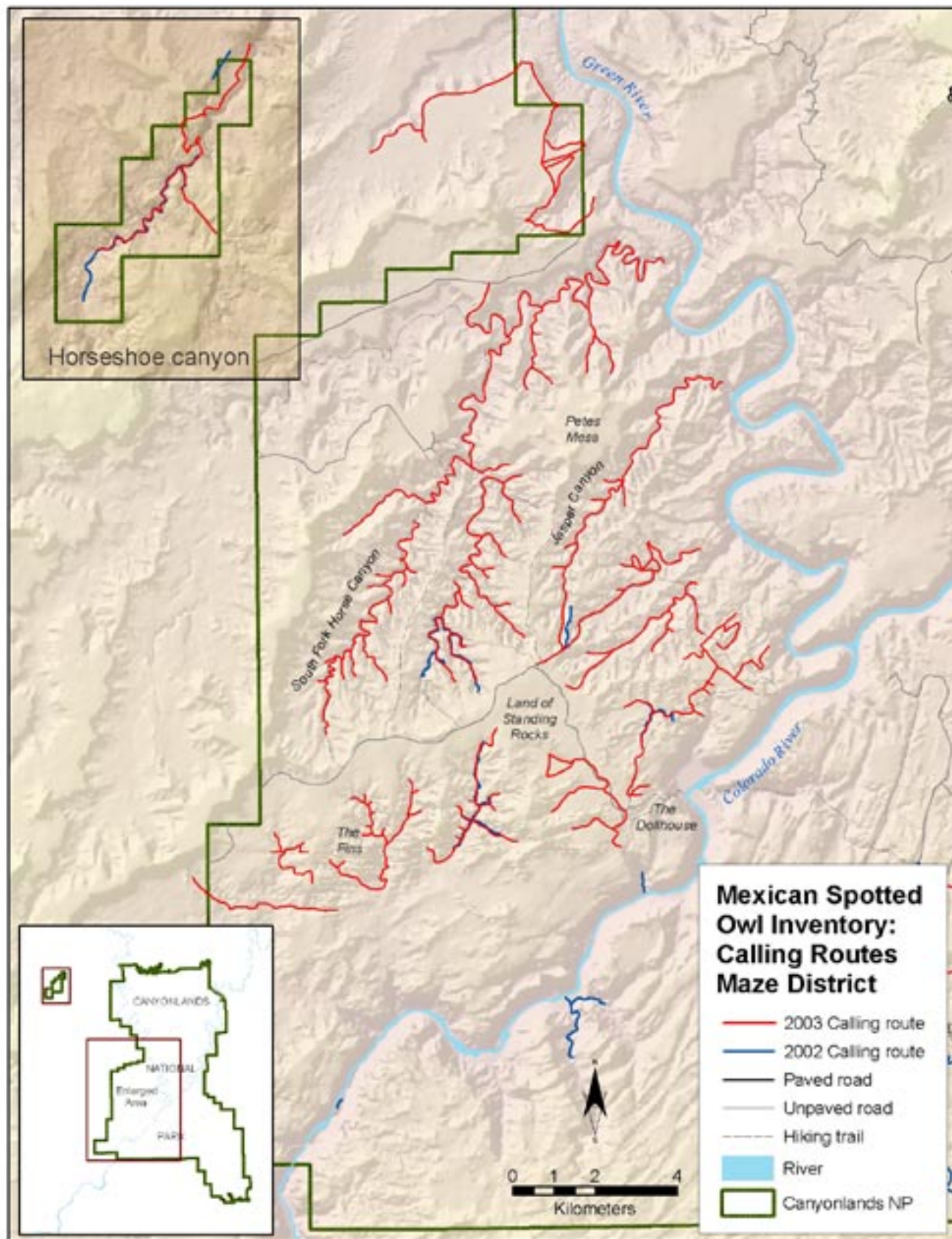


FIGURE 8. 2002-2003 Survey Routes in the Maze District of Canyonlands National Park.

3.2 MEXICAN SPOTTED OWLS CONFIRMED IN CANYONLANDS NATIONAL PARK

In 2002, very few owl responses were heard, and only nine Mexican spotted owls were confirmed within the park. However, 2003 was a very successful year with a total of approximately 38 MSOs observed in CANY (**Table 4**). Total observations for the two years included approximately 25 MSOs in the Needles District, 13 in the Island-in-the-Sky District, and 9 in the Maze District. A pair of owls in the Maze One PAC were observed by two park rangers, on two independent trips. The two park rangers, Dan McRoberts and Barb Zinn, observed the owls during the last couple of weeks of March, 2002. Dan McRoberts has conducted Mexican spotted owl surveys before, and both park rangers are active bird watchers. Although these owls were not observed by a currently trained Mexican spotted owl surveyor, we feel confident the owls were present. Of the 47 confirmed Mexican spotted owls within the park, eight were within or extremely close to existing PACs (One owl was on the edge of an existing PAC (Chesler Canyon), and one owl was 740 meters outside the nearest PAC (Davis Canyon) (see **Table 6** and **Figure 9**).

No juvenile Mexican spotted owls were observed during the 2002 field season. In 2003, We located four to six juvenile offspring of three pairs.

We focused most of our time on potential habitat outside of pre-existing PACs, in order to document new owl locations within Canyonlands National Park. We used a computer model of potential Mexican spotted owl

TABLE 4. Mexican Spotted Owls Confirmed During 2002-03 Field Seasons, CANY.

This Table contains sensitive information To obtain this information contact:

Charles Schelz / Biologist
National Park Service
Southeast Utah Group
2282 SW Resource Blvd.
Moab, Utah 84532
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charlie_schelz@nps.gov

We received reports of 9 additional Mexican spotted owls within CANY in 2002-2003 that we were not able to confirm. Gary Cox, a park ranger at the Maze District, reported observing a Mexican spotted owl occupying the Doll House PAC on April 4th, 2002. In addition to this report, we also had two reports of Mexican spotted owls well outside of established PACs. Gary Cox also reported flushing a Mexican spotted owl on February 24, 2002, near the west rim of Horseshoe Canyon. On April 14, 2002, a U.S. Forest Service aquatic biologist and self-proclaimed avid bird watcher from Ridgefield, Washington, reported hearing a pair of Mexican spotted owls at the Syncline Loop Campsite (see **Table 5 and Figure 8**). We conducted formal inventories in these three areas without success. Charles Schelz has heard MSOs in Salt Creek at the Angel Arch turnoff on a number of occasions between 1999 and 2002. Kevin Walker of Moab reported MSOs in the Five Fingers section of the Needles District.

TABLE 5. Unconfirmed Reports of Mexican Spotted Owls in CANY for 2002-2003.

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3.4 PROTECTED ACTIVITY CENTERS

All Protected Activity Centers (PACs) were surveyed in 2002-2003 except Five Fingers One, Five Fingers Two, and Horse Canyon One. Unconfirmed reports of owls in Five Fingers One and Five Fingers Two indicate activity in those areas. Of all the PACs surveyed, all were found to have owls except Buck Canyon, Lathrop Canyon, Big Spring Canyon, Chesler Canyon and Horse Canyon One (see **Table 6 and Figure 9**). Owls were found within one mile of the boundary of Big Spring Canyon and Chesler Canyon. These have been included as PAC residents in **Table 6**.

TABLE 6. 2002-03 Survey Status for Protected Activity Centers in CANY.

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FIGURE 9. Protected Activity Centers and 2002-2003 Mexican Spotted Owl Locations.

4. DISCUSSION

The 2003 field season was a very successful one for locating Mexican spotted owls in Canyonlands National Park. This was very heartening after the very limited observations of 2002. This region experienced the driest year on record in 2002. Climate experts believe 2002 to be the driest year in as many as 300 to 400 years. It appears that the dry weather of late 2001 and early 2002 triggered a “wait and see” response for the MSO; there was very little activity detected and no productivity during the 2002 spring through summer field season.

In 2003, there were 80 MSO observations representing at 44-47 owls (a couple may be duplicates) and approximately 25 territories. We also located four to six juvenile offspring of three pairs. Of particular interest was the number and density of MSOs in the Salt Creek watershed of the Needles District of Canyonlands National Park. Other than the river corridors, this is the most extensive canyon system of riparian habitat in Canyonlands National Park, and it contains numerous perennial pools. The Salt Creek watershed also provides the only direct wildlife corridor in the park to the nearby Abajo Mountains. The MSO was only found in the upper sections of Salt Creek, where the riparian areas are in very good to excellent ecological condition. This contrasts sharply with the lower mainstem of Salt Creek, where no MSOs were found. There was a four-wheel drive track open to vehicle use in the lower section until 1998. The riparian habitat in this section is in poor to good shape due to altered hydrological functions as a result of the road. We predict that as the system heals from the negative ecological effects of the road and the presence of vehicles, owls will begin to expand downstream.

4.1 PROTECTED ACTIVITY CENTERS (PACs)

Since we found a number of new MSO territories, new Protected Activity Centers should be considered for these areas, especially in the Needles District. Some existing PACs may be either expanded or changed to accommodate the new findings. Very few PACs occupied in the 1990s were unoccupied in 2002-2003. Of those not found occupied in the formal surveys, the Doll House pair was located by ranger Gary Cox in September, 2002. The Horse One PAC was not surveyed in 2003; in 2002 no owls were found, but the adjacent Separation Canyon PAC was occupied. The Lathrop Canyon and Buck Canyon PACs may have been inhabited by owls that have since moved to Dogleg Canyon and a small unnamed canyon south of Shafer Canyon and north of Musselman Canyon. Dogleg and the unnamed canyon are more remote areas along the White Rim, which may act as refuges from the increased visitor use and disturbance activities of the White Rim trail over the past ten years. An owl was heard in nearby Gooseberry Canyon in 2000 by Schelz, but none were found there in 2002-2003. Gooseberry Canyon contains excellent habitat and MSOs are expected there. An owl was found in upper Big Spring Canyon, and this area qualifies for PAC status.

The concept of PACs for Mexican spotted owls is somewhat controversial, with many biologists arguing that movement patterns of the MSO are not understood enough to assign static activity areas. It has been our experience that this argument has merit because of the movement within and without PACs that we have observed over the past ten years. We recommend that the PAC concept be more broadly defined to be more inclusive of available habitat and the extensive movements of MSOs. The critical habitat model is probably a better indicator of areas where MSOs are highly sensitive to disturbance. We recommend that the critical habitat model be refined for Canyonlands National Park and utilized in park planning instead of PACs.

4.2 GENERAL DISTRIBUTION OBSERVATIONS

Looking at the general distribution of owls in Canyonlands National Park we have come to a number of speculative conclusions. It appears that the MSO prefers areas where human activities and impacts are low in intensity and duration. This has been confirmed by Swarthout and Steidl (2000, 2001, 2003), Swarthout (1999), and Steidl (1996), and is evidenced by the existence of such a high density of MSOs in upper Salt Creek, Five Fingers, and the West Fork area, and by the apparent movement of MSOs away from the White Rim trail to more remote and less visited canyons. It appears that the MSO prefers areas where there is standing water and healthy pockets of riparian vegetation, such as upper Salt Creek, Shot Canyon, Lost Canyon, and Jasper Canyon, as opposed to the more human-impacted lower Salt Creek.

4.3 PRODUCTIVITY OBSERVATIONS

From data of the past two years of this project it is apparent that the MSO productivity and general activity levels vary greatly from year to year depending on weather patterns and the resulting availability of water and prey base. The MSOs primary prey base is small mammals, in particular packrats, deer mice, and voles. Many studies have concluded that small mammal populations are highly susceptible to varying weather conditions and plant productivity. When there is low plant productivity the negative effect ripples throughout the food chain. Long-term vegetation monitoring results for Canyonlands National Park show 2002 as the lowest vegetation production year in the 17-year history of the program (Schelz and Moran 2002). It appears that the MSO can withstand low primary productivity years by doing as little as possible and holding out for better times. Long-term monitoring of MSO productivity in CANY would be an excellent way of increasing our understanding of MSO and environment interactions. This understanding would assist greatly in the proper management and stewardship of this federally Threatened species.

4.4 PROTOCOL EFFECTIVENESS

For this basic inventory we visited sites only one time during the breeding season. It would be very interesting to do an effectiveness comparison between our “economy” one- visit technique and the four-visit protocol recommended by USDA National Forest Service and the USDI Fish and Wildlife Service (USDA National Forest Service 1991, USDA National Forest Service 2002). It is likely that increased visits would have resulted in finding more MSOs in Canyonlands National Park.

4.5 MANAGEMENT CONSIDERATIONS AND ONGOING THREATS

Visitor Impacts

The most significant threat to the MSO in Canyonlands National Park is increased **human activities** in the remote backcountry (Swarthout and Steidl (2000, 2001, 2003), Swarthout (1999), and Steidl (1996). Swarthout's (1999) studies concluded that cumulative effects of high levels of short-duration recreational hiking near nests may be detrimental to Mexican spotted owls. Swarthout and Steidl recommended a 205-meter radius buffer zone around occupied nests from mid-March until owls have finished nesting if unsuccessful or until the young fledge, which is generally in early June. With the visitor impact threat in mind, the CANY backcountry planning process should have critical habitat of the federally threatened Mexican spotted owl as a primary consideration.

Degradation of Riparian Areas

Another significant threat is the loss and degradation of riparian habitat. Riparian habitat provides invaluable cover and prey for the MSO in CANY. We have taken a very positive step in the protection of the MSO by closing part of the road in Salt Creek to vehicular traffic in 1998. Studies show that roads in general, and the Salt Creek road in particular, negatively alter the hydrologic functioning of the adjacent riparian habitat (Schelz 2001). Roads and trails in riparian areas can lower the water table to the extent that the once extensive riparian habitat shrinks or disappears. For these reasons, all roads and trails in CANY should be removed from riparian areas wherever possible, and where it is not possible, some basic design considerations should be incorporated to mitigate the negative effects to the riparian areas.

Scientific Over-Utilization

Scientific over-utilization is another threat to the MSO in CANY and elsewhere. High intensity and/or manipulative research can have severe effects on MSO longevity and productivity (USDI Fish and Wildlife Service 1995). Highly manipulative techniques, such as radio-tagging and feather banding, can have detrimental effects. Although these activities should probably not be totally banned, management must consider seriously the negative ramifications to the MSO population when allowing these activities. Less intrusive research based on old-fashioned intensive observation is the preferred course of action.

Surrounding Lands Management

There appears to be many more MSOs in CANY than in similar adjacent habitat. The MSO Recovery Plan provides a basis for management actions to be undertaken by land-management agencies and Indian Tribes to remove recognized threats and recover the Mexican spotted owl. Primary actions will be taken by the USDA Forest Service, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI Bureau of Indian Affairs, and sovereign American Indian Tribes (USDI 1995).

Most of the areas surrounding CANY are managed by the federal government, including the Bureau of Land Management (BLM), Forest Service (FS) and Glen Canyon National Recreation Area. Management of these areas should be monitored closely by CANY management for present and proposed activities that might have serious detrimental effects on the MSO. These activities include vegetation or habitat manipulation, riparian degradation by off-road vehicles and grazing, and oil and gas and mineral development. Oil and gas

and mineral development has been encouraged by the present administration and these activities are likely to increase in the near future. The noise and disturbance accompanying these activities may not directly affect Canyonlands National Park's Mexican spotted owls, but they will have an indirect effect. And in the surrounding areas, the noise and disturbance will have a direct effect on any present or future MSOs or MSO habitat. These activities can only serve to isolate CANY MSO populations further from other populations and thus have a long-term detrimental effect on our MSO population genetic stability, health, and survivorship.

5. RECOMMENDATIONS

- 1) Although we maximized the amount of effort toward this inventory so far for the amount of money received, we recommended that more money be allotted, so that we have time to perform more intensive surveys in all areas. Increased effort will help tease out some questions of the efficacy of more intensive surveys and of productivity numbers of specific known pairs. It will also help in better defining known Mexican spotted owl territories in high density areas like Salt Creek, or the Needles District in general. We have many questions about distribution, range, and critical habitat that could be answered with a little more money and time in the field.
- 2) We recommend more intensive non-intrusive monitoring of the Mexican spotted owl in Canyonlands National Park to better understand productivity, survival rates, dispersion patterns, and the intricate environmental interactions of the MSO with its habitat. In particular, it is important to monitor active nests and productivity over a period of time so that population dynamics can be followed and management adjustments can be made if necessary.
- 3) Areas that we recommend for more intensive future inventory include:

NEEDLES DISTRICT

- 1) Cleft Arch Fork, Lavender Canyon
- 2) Big Spring Canyon
- 3) Little Spring Canyon
- 4) Grabens
- 5) Upper forks of Davis Canyon

ISLAND-IN-THE-SKY-DISTRICT

- 6) Gooseberry Canyon
- 7) Soda Springs Basin
- 8) White Crack area

MAZE DISTRICT

- 9) Doll House area
- 10) East Fins
- 11) Upper Horseshoe Canyon
- 12) Lower Horseshoe Canyon
- 13) Horsethief Canyon
- 14) Lower Ekker Butte Canyon
- 15) Range Canyon
- 16) Millard Canyon

- 4) We recommend monitoring surrounding land management activities for links to negative effects on Mexican spotted owl populations in Canyonlands National Park and surrounding areas. Threats include vegetation or habitat manipulation, riparian degradation by off-road vehicles or grazing, oil and gas development, and mineral development.
- 5) For every presently allowed activity and every future plan at Canyonlands National Park, we recommend examining the possible effects on MSO populations and critical habitat. Activities in riparian areas should especially be examined. We recommend that where possible, all roads and trails within riparian areas in CANY be removed. Where not possible, some basic design considerations should be incorporated to mitigate the negative effects to the riparian areas. In particular, apply these principles to lower Salt Creek, where the road is still open to vehicles and has a negative effect on the creek's hydrology and riparian habitat development.
- 6) We recommend that the PAC (Protected Activity Center) concept be more broadly defined to be more inclusive of available habitat and the extensive movements of Mexican spotted owls. The critical habitat model is probably a better indicator of areas where MSOs are highly sensitive to disturbance. We recommend that the critical habitat model be refined for Canyonlands National Park and utilized in park planning instead of PACs.

If the decision is made to continue using PACs, we recommend the establishment of new MSO PACs based on the results of this 2002-2003 inventory. The following is a list of recommended new areas:

NEEDLES DISTRICT

- 1) Upper Big Spring Canyon
- 2) Lower Elephant Canyon
- 3) Upper Salt Creek, Big Pocket
- 4) Upper Salt Creek, Upper Jump
- 5) Upper West Fork Salt Creek
- 6) West Fork Salt Creek Confluence
- 7) Lavender Canyon
- 8) Squaw Canyon

ISLAND-IN-THE-SKY-DISTRICT

- 9) Dogleg Canyon
- 10) Musselman Canyon

MAZE DISTRICT

- 11) Lower Jasper Canyon
- 12) Shot Canyon
- 13) South Fork

- 7) We recommend the following research questions be considered for future research in Canyonlands National Park:
- a. Why are there more Mexican spotted owls in the park than in surrounding areas with similar habitat?
 - b. What degree of MSO inbreeding exists? Is there a healthy exchange of genes with other MSO populations?
 - c. Is the CANY MSO population isolated from other populations?
 - d. Is there interaction between the MSOs of the different districts of CANY?
 - d. Is the canyon-dwelling MSO a subspecies?
 - e. Do adults pursue new territories, or only juveniles?
 - f. Where can the CANY MSOs expand their territories?
 - g. What un-inventoried potential habitat exists in southeastern Utah?
 - h. How much overlap is there in adjacent territories? Does this change seasonally?
 - i. What do MSOs do when stressed?
 - j. How loyal are MSOs to nest/territory/mate over their lifetime? Do they flee with continuous disturbance?
 - k. What is the MSO diet in CANY? What are the proportions of their dietary components?
 - l. What is the MSO's relationship with water? How close do they need to be to a source of water? Do they utilize seeps or the rivers?

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APPENDIX A - Data Sheets


**Arches
Canyonlands
Hovenweep
Natural Bridges**
 SOUTHEAST UTAH GROUP

MEXICAN SPOTTED OWL INVENTORY FORM
CANYONLANDS NATIONAL PARK




TRANSECT #: Needles 3 DATE: 4/16/02 TIME: 20:02 PAGE: 1 of 3

LOCATION: Upper Left Canyon, Needles District, Canyonlands National Park DISTRICT: Needles
 OBSERVERS: David Swanson INVENTORY: ☒ INFORMAL MONITORING FORMAL MONITORING: ☐ (check one)

SURVEY TYPE: NIGHTTIME ☒ DAYTIME ☐ SURVEY # 1 COMPLETE SURVEY ☒ OUTING # 1 ABORTED ☐ VISIT RESULTS 2 570C
 WEATHER: START - WIND: 5-8 CLOUDS: 5-6 PFT: Q TEMP: 47 END - WIND: 3-6 CLOUDS: Q PFT: Q TEMP: 50

CALL POINT	GPS #	SURVEY METHOD	START	END	TOTAL TIME	CALL METR	MOON VIS	A	SEX	BEARING 1ST	BEARING 2ND	WIND	CLOUD	PFT	TEMP	UTM EAST	UTM NORTH	CH
1	MS71	2,3	20:17	20:53	14 min.	2	Y	N				5-8	5-6	Q	47	603752	424061	34
2	MS72	2,3	21:11	21:21	10 min.	2	Y					3-6	5-6	Q	51	604307	4246317	33
3	MS55	2,3	21:54	22:11	17 min.	2	N					0-2	Q	Q	51	604643	4246097	28
4	MS74	2,3	22:42	23:02	10 min.	2	N					0-2	Q	Q	54	604737	4246757	18
5	MS75	2,3	23:20	23:49	21 min.	2	N					8-12	Q	Q	52	605108	4247024	37
6	MS76	2,3	24:02	24:17	12 min.	2	N					3-6	Q	Q	50	605338	4246847	20
MS7A		2,3	24:40	24:52	12 min.	2	N	V	N	313°		3-6	Q	Q	50	605070	4247000	
MS7A		2,3	24:40	24:52	12 min.	2	N	V	P	318°		3-6	Q	Q	50	Same	Same	
MS7B		2,3	24:48	24:58	10 min.	2	N	V	N		234°	3-6	Q	Q	50	605120	4247134	
MS7B		2,3	24:48	24:58	10 min.	2	N	V	F		234°	3-6	Q	Q	50	Same	Same	

APPENDIX A - Data Sheets

		Arches Canyonlands Hovenweep Natural Bridges UTAH GROUP	
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**MEXICAN SPOTTED OWL DAYTIME FOLLOW-UP VISIT
CANYONLANDS NATIONAL PARK**




TRANSECT #: _____ DISTRICT: _____ DATE: _____ TIME: _____ PAGE: _____ OF _____
 LOCATION: _____ GENERAL HABITAT: _____ GEOL.FORM: _____
 QUAD MAP NAME(S): _____ VISIT # _____
 OBSERVERS: _____
 FOLLOW-UP VISIT FOR INVENTORY: _____ INFORMAL MONITORING _____
 DATE PRESENCE DETECTED _____ (for inventory follow-up visit)
 DATE SINGLE INFERED: _____ (for inventory follow-up visit)
 DATE PAIR CONFIRMED: _____
 UTM LOCATION: _____ E _____ N
 WEATHER:
 START: WIND: _____ CLOUDS: _____ PPT: _____ TEMP _____
 END: WIND: _____ CLOUDS: _____ PPT: _____ TEMP _____
 SURVEY BEGINS: _____ ENDS: _____ TOTAL TIME: _____
 OWL RESPONSE: (circle one) Visual Vocal None
 OWLS PRESENT: ADULT / SUBADULT: _____
 # NESTLINGS: _____ # YOUNG _____
 DEAD OWLS: (describe) _____
 REPRODUCTIVE STATUS: (circle one)
 Not Nesting Active on Nest Active but not on Nest Unknown
 MOUSING USED? Y or N NUMBER USED: _____
 FATE OF MOUSE TAKEN BY OWLS:

MALE	FEMALE	UNKNOWN SEX	
MOUSE 1: _____	MOUSE 1: _____	MOUSE 1: _____	MOUSE 5 _____
MOUSE 2: _____	MOUSE 2: _____	MOUSE 2: _____	MOUSE 6 _____
MOUSE 3: _____	MOUSE 3: _____	MOUSE 3: _____	MOUSE 7 _____
MOUSE 4: _____	MOUSE 4: _____	MOUSE 4: _____	MOUSE 8 _____




(I=Ignores; C=Cached; F=taken by Female; Y=taken by Young; N=taken to Nest;
 A=Ate; L=Left with mouse and fate unknown; G=mouse got away; H=Held for one hour)

 NEST LOCATED? Yes No EVIDENCE USED _____
 DAY ROOST LOCATED? Yes No
 OTHER RAPTORS HEARD OR SEEN: _____
 COMMENTS: (use back if needed) _____




APPENDIX A - Data Sheets

		Arches Canyonlands Hovenweep Natural Bridges SOUTHEAST UTAH GROUP	
MEXICAN SPOTTED OWL DAYTIME FOLLOW-UP VISIT CANYONLANDS NATIONAL PARK			
TRANSECT #: <u>Needles 3</u> DISTRICT: <u>Needles</u> DATE: <u>4/17/02</u> TIME: <u>12:30</u> PAGE: <u>1</u> OF <u>1</u>			
LOCATION: <u>Upper Lost Canyon</u> GENERAL HABITAT: <u>P/J</u> GEOL.FORM: <u>Cedar Mesa</u>			
QUAD MAP NAME(S): <u>Orvid Arch</u> VISIT # <u>1</u>			
OBSERVERS: <u>David Svendsen</u>			
FOLLOW-UP VISIT FOR INVENTORY: <input checked="" type="checkbox"/> INFORMAL MONITORING <input type="checkbox"/>			
DATE PRESENCE DETECTED <u>4/16/02</u> (for inventory follow-up visit)			
DATE SINGLE INFERED: _____ (for inventory follow-up visit)			
DATE PAIR CONFIRMED: <u>4/16/02</u>			
UTM LOCATION: <u>605071</u> E. <u>4217060</u> ELEV = <u>23</u> FT N			
WEATHER:			
START: WIND: <u>15-20</u> CLOUDS: <u>2</u> PPT: <u>0</u> TEMP <u>73</u>			
END: WIND: <u>15-20</u> CLOUDS: <u>2</u> PPT: <u>0</u> TEMP <u>75</u>			
SURVEY BEGINS: <u>12:30</u> ENDS: <u>13:20</u> TOTAL TIME: <u>1 hr</u>			
OWL RESPONSE: (circle one) Visual Vocal <u>None</u>			
OWLS PRESENT: ADULT / SUBADULT: <u>no owls observed on follow-up visit</u>			
# NESTLINGS: _____ # YOUNG _____			
DEAD OWLS: (describe) _____			
REPRODUCTIVE STATUS: (circle one)			
Not Nesting Active on Nest Active but not on Nest <u>Unknown</u>			
MOUSING USED? Y or <u>N</u> NUMBER USED: <u>2</u>			
FATE OF MOUSE TAKEN BY OWLS:			
MALE	FEMALE	UNKNOWN SEX	
MOUSE 1: _____	MOUSE 1: _____	MOUSE 1: _____	MOUSE 5: _____
MOUSE 2: _____	MOUSE 2: _____	MOUSE 2: _____	MOUSE 6: _____
MOUSE 3: _____	MOUSE 3: _____	MOUSE 3: _____	MOUSE 7: _____
MOUSE 4: _____	MOUSE 4: _____	MOUSE 4: _____	MOUSE 8: _____
(I=Ignores; C=Cached; F=taken by Female; Y=taken by Young; N=taken to Nest; A=Ate; L=Left with mouse and fate unknown; G=mouse got away; H=Held for one hour)			
NEST LOCATED? Yes <u>No</u> EVIDENCE USED _____			
DAY ROOST LOCATED? Yes <u>No</u>			
OTHER RAPTORS HEARD OR SEEN: <u>NA</u>			
COMMENTS: (use back if needed) <u>See Back</u>			

APPENDIX A - Data Sheets

		Arches Canyonlands Hovenweep Natural Bridges UTAH GROUP	
MEXICAN SPOTTED OWL FORMAL MONITORING (SURVEY) SUMMARY CANYONLANDS NATIONAL PARK			
TRANSECT #: _____ DISTRICT: _____ DATE: _____ TIME: _____ PAGE: _____ OF _____			
LOCATION: _____ GENERAL HABITAT: _____ GEOL.FORM: _____			
QUAD MAP NAME(S): _____			
OBSERVERS: _____			
NIGHTTIME SURVEYS: _____			
Complete Survey #1: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #2: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #3: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #4: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #5: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #6: Date Started _____ Date Completed _____ Results: _____			
DAYTIME FOLLOW-UP VISIT (within 48 hrs, mouse and find pair, 4 hour search):			
Visit #1: Date _____ Follow-up Result: _____			
Visit #2: Date _____ Follow-up Result: _____			
Visit #3: Date _____ Follow-up Result: _____			
Visit #4: Date _____ Follow-up Result: _____			
Visit #5: Date _____ Follow-up Result: _____			
Visit #6: Date _____ Follow-up Result: _____			
REPRODUCTIVE VISIT RESULTS (if find pair May 15 – July 31):			
Visit #1: Date _____ Follow-up Result: _____			
Visit #2: Date _____ Follow-up Result: _____			
Visit #3: Date _____ Follow-up Result: _____			
Visit #4: Date _____ Follow-up Result: _____			
Visit #5: Date _____ Follow-up Result: _____			
SEARCH FOR YOUNG (if find young, 1 hour search, 300 yards):			
Visit #1: Date _____ Follow-up Result: _____			
Visit #2: Date _____ Follow-up Result: _____			
COMMENTS:			

APPENDIX A - Data Sheets

		Arches Canyonlands Hovenweep Natural Bridges SOUTHEAST UTAH GROUP	
MEXICAN SPOTTED OWL FORMAL MONITORING (SURVEY) SUMMARY CANYONLANDS NATIONAL PARK			
TRANSECT #: <u>Needles 3</u> DISTRICT: <u>Needles</u> DATE: <u>7/26/02</u> TIME: <u>11:15</u> PAGE: <u>1</u> OF <u>1</u>			
LOCATION: <u>Lost Canyon</u> GENERAL HABITAT: <u>P/J</u> GEOL. FORM: <u>Cedar Mesa</u>			
QUAD MAP NAME(S): <u>Orvid Arch</u>			
OBSERVERS: <u>David Svendsen</u>			
NIGHTTIME SURVEYS: <u>3</u>			
Complete Survey #1: Date Started <u>4/16/02</u> Date Completed <u>4/18/02</u> Results: <u>2 STOL'S</u>			
Complete Survey #2: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #3: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #4: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #5: Date Started _____ Date Completed _____ Results: _____			
Complete Survey #6: Date Started _____ Date Completed _____ Results: _____			
DAYTIME FOLLOW-UP VISIT (within 48 hrs, mouse and find pair, 4 hour search):			
Visit #1: Date <u>4/17/02</u> Follow-up Result: <u>NO OWLS OBSERVED</u>			
Visit #2: Date _____ Follow-up Result: _____			
Visit #3: Date _____ Follow-up Result: _____			
Visit #4: Date _____ Follow-up Result: _____			
Visit #5: Date _____ Follow-up Result: _____			
Visit #6: Date _____ Follow-up Result: _____			
REPRODUCTIVE VISIT RESULTS (if find pair May 15 – July 31):			
Visit #1: Date _____ Follow-up Result: _____			
Visit #2: Date _____ Follow-up Result: _____			
Visit #3: Date _____ Follow-up Result: _____			
Visit #4: Date _____ Follow-up Result: _____			
Visit #5: Date _____ Follow-up Result: _____			
SEARCH FOR YOUNG (if find young, 1 hour search, 300 yards):			
Visit #1: Date _____ Follow-up Result: _____			
Visit #2: Date _____ Follow-up Result: _____			
COMMENTS:			

APPENDIX B - MSO Protocols

3/94

Mexican Spotted Owl Inventory Protocol

Introduction.

The Regional inventory protocol requires two years of survey where no owls are found prior to an activity proceeding. When an owl is located, a management territory of at least 2,000 acres is established at this site. Any of the area outside the territory boundary that is not included in another management territory requires a second years survey.

Objective: to standardize procedures used to inventory Mexican spotted owl habitat in order to find owls or have reasonable assurance of absence.

Use the following methodology when conducting spotted owl inventories. All persons conducting inventory work under these protocols will meet training standard requirements.

1. Survey Design.

- a. Design daytime and nighttime calling routes to insure complete coverage of suitable habitat within the survey area. All suitable habitat must be within 0.5 miles of a calling point or continuous calling route.
- b. Ensure calling routes and points along routes are no more than 0.75 miles (preferably 0.5) apart, straight line distance. Occasionally, the distance between calling points may be increased to 1.00 mile (preferably 0.75), but less than 5 percent of a survey area should have more than 0.75 miles between calling points. Include reasons for exceeding 0.75 miles between calling points in the documentation of your biological evaluation.
- c. Locate the calling routes and points in a survey area so that all suitable habitat within the survey area would be called, that calls given by the person conducting the field outing would be heard by a spotted owl, and that the caller would hear an owl's response.
if more than 1 mile wide do both (caution)
- d. Use nighttime field outings for all continuous or point calling routes in an inventory area unless safety dictates a daytime field outing is necessary.
- e. Consider the size of the survey area when designing the calling routes.
- f. Ensure you have sufficient callers to attain a complete survey within the 7 day time limit, based on the number of field outings and types of methods to be used for this area.
- g. Fixed calling points are not necessary, but consistency in obtaining complete coverage is.
(Remember your points)
- h. Include considerations for survey cost and efficiency while still obtaining complete coverage when designing routes.

APPENDIX B - MSO Protocols

2. Survey Method.

a. Select the best survey method for the situation and/or terrain when designing for complete coverage. It will likely take combinations of methods; including calling point, leap frog, and/or continuous calling routes; to obtain complete coverage of an area. *20 minutes*

3. Complete Survey. *You can combine cont. calling w/ leap frog but NO continuous calling allowed*

a. A complete survey may be a combination of daytime and nighttime calling outings for a given survey area. *4 nighttime surveys*

b. It is a set of one or more field outings in an inventory area that obtains complete coverage.

c. Complete all field outings of a survey area within 7 consecutive days to attain a complete survey.

d. Wait at least 5 full days before beginning the next complete survey but start it within 21 days after completion of previous survey. For example, one complete survey is finished on May 5. The next complete survey cannot begin before May 11, and must begin before May 26.
Exception: (NO MORE THAN ONE SURVEY IN JUNE)

NO e. In remote areas you may conduct two complete surveys during one trip into the area. If this option is used, allow a minimum of two days between complete surveys. Conduct all field outings required for a complete survey prior to repeating any route for the second survey. Wait a minimum of 15 and maximum of 30 days before starting the next two surveys.

f. Conduct at least four complete surveys of the survey area during the field season. You may conduct additional surveys in an area if you have reason to believe owls are there, but you have not found them. Note this on the inventory form.

WATER g. Conduct no more than one complete survey prior to April 16. *9. 2 surveys - (1 MAR - 30 APR)*

h. Conduct the first complete survey prior to July 1. *H. 1 survey max during JULY*

i. Finish at least three complete surveys prior to August 1. *I. all surveys completed BY 30 SEPT*

j. Consider vocal or visual locations of owls outside of the field season as historical information.

NO k. Apply the following in situations where the first complete survey occurs during the period of July 1 to August 31: Management Territories are established for owls found prior to September 1; negative surveys do not contribute towards the 2 year survey requirement.

l. The preferred calling time is at night. The two hour time periods following sunset and preceding sunrise provide the best times to locate owls in or near day roosts or nests.

m. Conduct a field outing only when conditions will likely allow for completion of an effective outing. Do not conduct field outings during existing or predicted windy (>15 mph) or stormy weather, nor when there are access problems due to road conditions or snow.

START HOOTING 1 HOUR BEFORE SUNSET.

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APPENDIX B - MSO Protocols

n. You may discontinue field outings in a given area when it is evident the entire area being searched is occupied by one or more Management Territories having a single or pair present. Use professional judgment and such factors as terrain, size of the area being inventoried, and so forth, when making this determination.

IF YOU FIND AN HORNED OWL YOUR JOB IS DONE

o. Conduct at least two complete surveys prior to making a determination to discontinue field outings because the entire area is occupied by owls. Use the remainder of the time you would have used doing the last two complete surveys to conduct daytime follow-up visits to find a day roost or the nest tree.

NO

Note: Between March 1 and May 1, use people already on beard, bring on temporaries in an intermittent status for the days (nights) field outings are to be conducted, or include these dates in your contracts to allow contractors to begin early. Do not bring on temporaries in a full time status unless you already have other work for them to do during the time they are not able to call and you are able to adjust their work schedule accordingly, from night to day and back again.

NO

4. Calling.

a. Spend at least *20* minutes at each calling point.

b. Alternate calling and listening, giving a call or series of calls about every minute and listening between calls.

c. Use recorded calls of the Mexican spotted owl, vocal imitations of these calls, or combinations of both when doing surveys.

d. Use the four note hoot call as the primary call. *SEALS + WHISTLE.*

e. Use other calls individually or in combinations to provide a good mix of calls.

f. Continue calling but proceed with caution if predators, such as a great-horned owl, are detected in areas where the presence of spotted owls is undetermined. *MOVE TO NEXT POINT.*

IF HE FOLLOWED YOU - WAIT AND A POINT

g. Discontinue calling at any point a predator is detected in an area where spotted owls are known. Wait at least 30 minutes and call again to determine if the predator is still in the area. If the predator continues to respond after waiting 30 or more minutes, move 1/2 or more miles along the calling route and continue calling. If the predator follows you discontinue calling this route and go to another route if time permits.

h. Use intermediate calling points when weather or other factors increase the probability of not getting complete coverage.

i. Spend 2 to 3 minutes at each intermediate calling point. Alternate calling and listening as in 4b.

5. Once an Owl is Heard.

a. Take a bearing from your calling location to the location where the owl responded from. Record both the location where the owl responded from and your calling location on the map.

ADD COMMENTS TO EQUIPMENT LOG

SPOTLIGHT

(1-3/94) - 3

APPENDIX B - MSO Protocols

and forms. Attempt to get two or more bearings on an owl by using a calling location a short distance from the calling location where the first response was heard.

b. Provide the best location you can of where you think the owl was located without chasing after the owl.

c. Locate this on the map.

d. Record the type of call you gave and the type of call the response was.

e. Identify the sex of the owl(s) responding to your call when possible.

f. Go to next calling point and continue the field outing.

g. If it becomes evident an owl is following you, stop calling and move on to the next calling point, or a distance of about three-fourths mile.

h. Report the location and bearing of all other species of raptors heard, the same as you would for a spotted owl.

6. Daytime Follow-up Visits.

a. Conduct daytime follow-up visits (a 4 certified person-hour search in a 1/4-1/2 mile radius from detection) in all areas where presence was detected during a field outing. The objective is to confirm single or pair occupancy and to locate nest or roost sites.

b. Complete a daytime follow-up visit within 48, and preferably 24 hours, after presence is detected.

c. Conduct daytime follow-up visits in the early morning or late afternoon/early evening whenever possible. The first 2-3 hours following sunrise and the last 2-3 hours prior to sunset are the best times to have an owl respond to a call.

Understand d. Use mousing to locate a pair of owls, nest, or roost area once a single has been confirmed.

e. Discontinue calling if a predator such as a great-horned owl, red-tailed hawk or goshawk responds to your calls, or is seen in the area.

f. Continue your visual search effort.

g. Begin calling again when you believe the predator has left the area.

h. Proceed with caution.

i. If you are not able to continue calling for any reason and feel the search effort was not satisfactory because of the presence of predators or weather, conduct another daytime follow-up visit as soon as possible.

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7. Record Keeping.

- a. Record all survey activities on prescribed inventory or daytime follow-up forms. Complete all blocks of each form using the keys provided.
- b. Attach a copy of the field map to each form. Label the map with the inventory area name, topo quad it is found on, and date.
- c. Complete a final map that summarizes all of the field maps.

8. At the End of the Field Season.

- a. Establish Management Territories where owls are found. Record the management territory number on each form containing a vocal or visual identification of a Mexican spotted owl used to determine that territory.
- b. Determine all portions of the survey area where no portion of a Management Territory was established.
- c. Conduct a second year of inventory following the same procedures in any portion of the survey area where no Management Territory was established during the initial spotted owl inventory of this survey area.
- d. Send ledgable copies of all forms and maps to the ^{TO LAURA} ~~Regional Office~~ at the end of the field season, including a copy of the summary map.

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9. Inventory Definitions. Use this list of standard terms and definitions when referring to spotted owl inventory activities to reduce potential misunderstandings and provide greater consistency throughout the Region.

Absence. Assumed when no response is recorded after second year of inventory protocol is completed in a defined area.

Adult. A Mexican spotted owl > 2 years old. Usually does not have the whitish terminal band on the tip of its tail used to distinguish juveniles. Terminal band not pointed if present. The tail appears rounded.

Breeding Season. That time period from February 1 through August 31 which includes the courtship, nesting, nestling, and fledgling-dependency periods.

Calling Points. Locations distributed throughout an area to attain complete coverage of the survey area being inventoried for spotted owls. A minimum of 15 minutes is spent at each point. Calling points are not rigorously applied as fixed points used in Formal Monitoring and generally need to be in the same vicinity for each complete survey.

Calling Route. An established route in a survey area where vocal imitations or recorded calls of spotted owls are used to elicit a response from all spotted owls that will respond. Calling routes may include calling points and intermediate points but they often use continuous calling or leap-frog methods.

Calling Outing. A nighttime or daytime outing to obtain complete calling coverage of the inventory area.

Capable Habitat. Habitat that was suitable at some time in the past but does not currently provide the characteristics of suitable habitat and is not occupied by Mexican spotted owls. It has the capability of attaining the characteristics of suitable habitat at some time in the future through prescribed management treatments or natural processes.

Complete Coverage. The intent of obtaining complete coverage is to elicit a response from all owls in the survey area that will respond to a spotted owl call and have the person conducting the field outing hear and locate their response. 100 percent of the suitable habitat in an area surveyed must be within 1/2 mile of calling routes or points.

Complete Survey. One of 4 replicate sets of one or more field outings in a survey area that attains complete coverage of the survey area within the 7 day time period. The objective is to detect spotted owls.

Continuous Calling. Call at regular or irregular intervals while walking along an established route. Listen for a response for a short period of time.

Daytime Follow-up Visit (Inventory). A daytime follow-up visit is a four certified person-hour, or longer, walk-through search within a minimum of a one-quarter and generally not more than one-half mile radius around the location where at least presence has been established.

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Field Outing. Each trip to the field associated with conducting protocol activities. For inventory it includes nighttime and daytime calling outings and daytime follow-up visits.

Field Season (Inventory). March 1 through August 31.

Fledgling. An owl of the year that is out of the nest but unable to completely care for itself. It is considered fledged when it is fully feathered and capable of flying, generally by September. Gives only juvenile begging call.

Historical information. Owl location information obtained outside the field season. It is not to be used to establish occupancy or reproductive status for a given year.

Intermediate Points. Calling locations between identified calling points or routes to attain complete coverage. Used to improve coverage when conditions require it. Not required to be established prior to the field outing used.

Juvenile. An owl less than 2 years old. Usually identified by tail-feathers that have a pointed whitish terminal band. The point and terminal band tend to wear off as the owl ages making it difficult to distinguish a juvenile owl, during its second year, from an adult.

Leap Frog Calling. The leapfrog method is very useful when driveable roads allow coverage of all or a portion of the survey area. It requires two people, but nighttime inventories are best accomplished by two people from a safety standpoint. One caller begins calling while the other person drives the vehicle ahead to a predetermined point, usually about a half mile, leaving the vehicle for the first person, and they continue on down the road like this. It often involves continuous calling.

Mixed Conifer Type. A forest type usually dominated by Douglas-fir (*Pseudotsuga menziesii*) and/or white fir (*Abies concolor*) and usually having ponderosa pine (*Pinus ponderosa*) southwestern white pine (*P. strobiformis*), and/or limber pine (*P. flexilis*) present. It frequently contains Rocky Mountain maple (*Acer glabrum*), boxelder (*A. negundo*), bigtooth maple (*A. grandidentatum*), Gambel oak (*Quercus gambelii*), aspen (*Populus tremuloides*), or other hardwood species. Engelmann spruce (*Picea engelmannii*), blue spruce (*P. pungens*), and/or sub-alpine fir (*Abies lasiocarpa*) may be present at the higher elevations or in the cold air drainages. Hardwood species comprise less than 40 percent of the stand. Douglas-fir and/or white fir comprise at least 25 percent of the stand and ponderosa pine is less than 60 percent of the stand.

Mousing. Feeding mice to owls. The most efficient way to locate nests, females, and young. The assumption is that an adult male will take a mouse to a female on the nest, or to a female for her to feed the young, or to the young itself, thus locating the nest, mate and/or young.

Nest. A spotted owl nest is a platform on which eggs are laid. Suitable nest substrates include: broken topped trees, old raptor nests, witches brooms, rock outcrops, caves, or cliff ledges. A Mexican spotted owl must be observed using the structure. Use includes: copulation, female in nest, young in nest, etc.

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Recording. An owl or the year that is seen in the nest.

Observer/surveyor/caller. Used interchangeably in this document. These terms refer to the person doing spotted owl inventories.

Occupancy Classification. A classification used in inventory and monitoring that includes the following classes: 1) absence, 2) presence, 3) single inferred, 4) single confirmed, 5) pair inferred, and 6) pair confirmed.

Other Hardwood Forest Types. Hardwood forest cover types important for the Mexican spotted owl. These include live oak woodlands, Arizona sycamore (*Plantanus wrightii*), Arizona cyprus (*Cupressus arizonica*), and hardwood riparian types (combinations of boxelder, maple, cottonwood, (*Populus spp.*), willow (*Salix spp.*), alder (*Alnus spp.*) or Arizona cyprus).

Pair Confirmed. A pair(s) of owls is confirmed if any of the following are observed:

- (a) One spotted owl is observed roosting within 200 yards of its mate;
- (b) A male is observed and female is still on the nest;
- (c) Young spotted owls are observed;
- (d) A vocalization by one owl and the visual observation of another, of the opposite sex, within 200 yards of each other during a 10 minute time period during either the daytime or nighttime.
- (e) Male and female owls are vocalizing back and forth within 200 yards of each other during a 10 minute time period during the daytime.

Pair Inferred. A pair of owls is inferred when one of the following are observed:

- (a) Vocalizations of young are heard but not seen and adults are not seen or heard.
- (b) Male and female owls are vocalizing with each other within a 10 minute time period within 200 yards of each other during a nighttime field outing, but a daytime follow-up visit confirms only one bird and vocalizations of the mate are not heard.
- (c) Male and female owls are vocalizing back and forth to each other within a 10 minute time period and within 200 yards of each other during two nighttime field outings, but daytime follow-up visits do not find any owls present.

Pine/oak Type. Forest cover types with a pine overstory and an oak understory. Oak comprises at least 10 percent of the stand's basal area in trees 5 inches and larger. Determine oak basal area from diameter at root crown (DRC). Ponderosa pine and Gambel oak are the most common species making up these types, but Apache pine (*Pinus engelmann*) or Chihuahuan pine (*P. leiophyll*) and live oaks (*Q. arizonica*, *Q. emoryi*, *Q. chrysolepis*, *Q. hypoleucoides*, *Q. rugosa*, *Q. oblongifolia*, *Q. grisea*, and other oaks) form a number of types, especially in southeastern Arizona and southwestern New Mexico. Pinyon pine (*Pinus edulis*) and juniper (*Juniperus scopulorum*, *J. monosperma*, *J. utahensis*, or *J. deppeana*) trees are occasionally present.

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Point Calling. A survey method where the surveyor calls for a specified period of time at each calling point and then moves to the next point.

Ponderosa Pine Type. A forest cover type with ponderosa pine making up at least 60 percent of the stand. Other conifers or hardwood species make up the remainder. Conifer species other than ponderosa pine or hardwood species make up less than 25 percent of the stand's basal area as individual groups or 40 percent of the stand collectively. Gambel oak comprises less than 10 percent of the stand's basal area.

Potential Foraging Habitat. Habitat that may be used by the owl for foraging. It usually cannot attain the characteristics of suitable habitat.

Predator. Potential Mexican spotted owl predators include great-horned owl, goshawk, and red-tailed hawk. Great-horned owls have been known to prey on spotted owls especially young and dispersing juveniles. The incidence rate of predation is not known but thought to be low. The goshawk and red-tailed hawks are thought to prey on MSO at even lower rates than the great-horned owl. Bald and golden eagles, peregrine falcons, and other avian predators may prey on MSO on rare occasions, but should not generally be considered potential predators.

Presence. Occupancy classification determined by a vocal response given by one or more spotted owls during only one field outing at one location.

Remote Area. Any survey area which requires more than 4 hours of travel time by vehicle and/or foot during good road, trail and weather conditions (good for the road or trail in question) to reach from the District Office.

Roost. Tree, cliff ledge, rock, or log used by a Mexican spotted owl for extended rest periods. A roost site consists of the tree used to perch in and all other trees whose crowns overlap or interlock with the perch tree. Identified by observations of the owl and presence of pellets, white-wash, and other evidence indicating a spotted owl's roost. Classed as: a) day-roosts - characterized by sites used during the day that provide a cool moist microclimate or b) night-roost - used for resting during night foraging.

Single Confirmed. A single spotted owl located during a daytime field outing, daytime follow-up visit, or a nighttime visual observation by a person certified by the Forest Service to conduct inventories.

Single Inferred. Auditory responses heard during two or more separate nighttime field outings with no visual observation of a spotted owl.

Subadult. Fully feathered but less than 2 years old. The points of the terminal tail band tend to wear off as the owl ages, making it difficult to distinguish a 2nd year subadult from an adult.

Suitable Habitat. Suitable habitat is defined as those habitats that meet the year-round needs of the owl. It provides the conditions used by the owl for nesting, day-roosting, and foraging; however it need not be occupied to be considered suitable. Any habitat used by the owl for nesting and/or day-roosting during the breeding season whether it meets the following characteristics or not is considered suitable habitat for that pair or site. Between 20 and 40 percent of Mexican spotted owls inhabit a variety of canyons. These vary from ones with a

APPENDIX B - MSO Protocols

in the canyon. The one common character among these is steep to vertical rock walls being present in all or part of the canyon. The remaining owls inhabit forested sites. Forest cover types providing suitable habitat include: 1) mixed conifer, 2) pine/oak, 3) other hardwood types, and occasionally 4) ponderosa pine. The following structural characteristics provide the best description of what we know about suitable forested habitat.

(a) Moderately closed to closed canopy; generally greater than 70 percent closure in mixed conifer (minimum of 60%) and 60% in ponderosa pine, pine/oak, and other hardwood types (minimum of 50%).

(b) Multi-storied stands containing several canopy layers comprised of conifer and hardwood trees and shrubs greater than approximately 8 feet in height.

(c) Stand age and tree size are generally in the mid-age, mature, or old forest developmental stages. The size of the dominant and co-dominant trees in the main canopy generally range from 12-18 inches DBH in the mid-age class and greater than 18 inches DBH in the mature and old forest stands. Young stands are sometimes used for nesting and day roosting. In these young stands the dominant and co-dominant trees range from 9-12 inches DBH.

Additional characteristics often present in suitable habitat include:

(a) A component of large trees, often old remnants, is generally found in younger stands and is often present in mature stands.

(b) Often contains rock outcrops, cliffs, or talus.

(c) Standing dead and large down woody material are often present.

(d) Often the stands are diverse with a mix of small openings, not of uniform density throughout.

Survey or Inventory Area. The area in which spotted owl inventory is conducted.

Survey Methods. Methods used in spotted owl inventories which include 1) continuous calling, 2) leap frog, 3) calling point, and 4) fixed point for Formal monitoring.

Training standards. Standards established for all persons doing spotted owl inventory work to ensure they recognize spotted owls, their predators and understand the protocol.

Travel Time. The time it takes to travel from the District office to the starting point of the closest route in a survey area.

Unsuitable. Does not provide the characteristics of suitable habitat. It is not used for nesting but may be used for foraging and occasionally for roosting. It does not have the capability of attaining the characteristics of suitable habitat at any time in the future through prescribed management treatments or natural processes.

Young. Owls of the year that are out of the nest but not fully feathered. May be capable of gliding or flying. Gives only juvenile begging call.

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APPENDIX C - INCIDENTAL RAPTORS

INCIDENTAL RAPTORS, MSO INVENTORY, 2003

(Time sequential: all locations plotted on survey maps)

Screech, 270° from Lower Elephant 6
Screech, Doll's House 36
Golden Eagle and Kestrel, Fins 10a
Screech, 213° from Horseshoe 6
Peregrine falcon, Davis 16
Great horned owl, Horse/Pete's Mesa 14
Screech, Horse/Pete's Mesa 12
Screech, Horse/Pete's Mesa 17
Screech, WNW of North Flat confluence between 36/37
Screech, same as above, 128° from Standing Rock
Screech, Maze 53a/54
Screech, 188° from Taylor rough fork 19
Screech, 86° from Shafer top 10b
Screech, 148° from Aztec Butte 11/12
Great horned owl, 29° from Slick Rock Trail parking lot, 55° from 10
Peregrine falcon, Lockhart 51
Cooper's hawk, Co. River bottom downstream from Horsethief Canyon
Cooper's hawk, mouth of Elephant Canyon
Turkey vulture, first camp on river left, downstream from The Confluence
Peregrine falcon, north end of Spanish Bottom
Kestrel, just up Monument Canyon from mouth
Golden eagle, Musselman 26
Screech, 325° from Upper Salt Creek 70
Harrier hawk pair, upper Kirk's Spring 81
Screech, Horseshoe 5
Kestrel pair, Horseshoe 22
Red-tail hawk, Salt Creek 27
Peregrine falcon, Peek-a-boo 5

APPENDIX D - INCIDENTAL AMPHIBIANS

INCIDENTAL AMPHIBIANS, MSO INVENTORY, 2003

Listed sequentially—dates and plotted locations on MSO survey maps

All observations are BUfo PUnctatus unless otherwise noted

Water Canyon, Maze 15b
Cleft Arch, Lavender Canyon
South Fork of Maze 10, 13, 15, 25, 44, 45
SALAMANDER, Kirk's Spring
SALAMANDER, Upper Jump Spring
Lower Horse Canyon 10, 13
Upper South Fork of Maze 1, 7
BULLSNAKE, ISKY entrance road on Big Flat
Alcove Spring, Neck Spring Trail 29
Alcove Seep, Taylor Canyon 2
Upheaval Canyon 8 to 9
Taylor Canyon 11 to 12
Slickrock Trail 8, 9
SPEA, Slickrock Trail between 8 and 9
Big Spring Canyon 53
Musselman Canyon 25
WHIPSNAKE, BUPU, BUWO, Peekaboo campground
Buck Canyon 72a
Gooseberry Canyon 79
BUPU and BUWO, Indian Creek 105
BUWO, Salt Creek 75
BUPU and SPEA in Upper Jump Spring
BUWO, Salt Creek 33, 35, 38
Westfork of Salt Creek 11
Westfork of Salt Creek 13, 16 (tadpoles)

